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VOLUME XVII

The Book of Knowledge

The Children's Encyclopedia

THAT LEADS TO LOVE OF LEARNING

Editor-in-Chief
E. V. McLOUGHLIN, L.H.D.

Educational Consultant
LEONARD POWER, Ed.D.

With an Introduction by
ALEXANDER J. STODDARD, Ed.D., L.H.D., LL.D.

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E

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This is a guide to the principal contents of this volume. It is not possible to give all of the questions in the Department of Wonder, but the pages are given where such sections begin. The big Index in Volume 20 is a guide to your whole set. There you will find every subject that is in The Book of Knowledge.

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Courtesy, Harry T. Peters

The Champions of the Mississippi. Boat-racing was a sport enjoyed by thousands of spectators, who lined the banks.

THE MISSISSIPPI

THE Indians called it Father of Waters, this great stream that gathers up the waters from 1,257,000 square miles of land and carries them down through the heart of the continent to the Gulf of Mexico. When we speak of the Mississippi River, we usually have in mind the Lower Mississippi, the 2,000-miles stretch from the Falls of Saint Anthony at Minneapolis to the Gulf. That is where the biggest tributaries, the Missouri, Ohio, Arkansas and Red rivers, join the main stream; where millions of tons of the products of mines and farms and factories are towed up and down the river in long strings of barges.

This is the river of romance, down which Huckleberry Finn and Jim floated on their raft; where, a hundred years ago, the white-painted river steamers, looking rather like decorated wedding cakes with their dazzling scrollwork ornamentation, carried rich planters and their families, and dignified merchants, as well as gamblers and scamps, between St. Louis and Natchez, Memphis and New Orleans. The French explorer, La Salle, lost his life searching for the mouth of this great stream; and the Spaniard, De Soto, killed on its banks by hostile Indians, was buried in its depths by his men.

Spain, France and England schemed and fought for the control of this watery highway, and finally the United States bought the whole Louisiana Territory in order to assure an outlet for the products of the West through the port of New Orleans. When the American Civil War was fought in the 1860's, it was Grant's capture of Vicksburg and the opening of the Mississippi to the Union forces that broke the back of the Confederacy and saved the Union. The Mississippi is also a river of history.

If you will look at a map of the United States you will see that the Mississippi River with all its tributaries looks rather like a tree. The delta where the river's many mouths flow into the Gulf looks like a tree's roots, the broad Lower Mississippi looks like the trunk, and the big tributaries are the tree's main branches. All of the tiny streams that flow into larger streams to join the big tributaries are like the twigs. On the map you will see that the branches and twigs of this tree-like river system extend to the Rocky Mountains in the west and to the Appalachians in the east. If you were to stand on the banks of the little Allegheny River in upper New York State and throw a stick into its waters, that stick could quite easily turn up many days later in the Gulf of Mexico, having floated down the Allegheny into the Ohio, and into the Mississippi at Cairo, Illinois.

THE SOURCE OF THE GREAT MISSISSIPPI

Of course, a tree grows from its roots upward and outward, while a river flows from its outermost "twigs" downward and inward. There are a number of little streams which might be considered the source of this great river system, but the true source is generally considered to be a little group of springs in northern Minnesota. The water from these springs flows through Lake Itasca, a pretty little lake among the northern forests. When the stream leaves Lake Itasca it is not more than twenty feet wide and two feet deep, but it has become what its discoverer, the Frenchman Nicollet, called "the Infant Mississippi." Let us see how it grows.

THE COURSE OF THE MISSISSIPPI IN MINNESOTA

As the river pushes on its way it becomes broader and more tranquil, but when it arrives at Minneapolis and St. Paul, the great north-central manufacturing cities, it is still a very moderate-size stream, though it has already flowed more than 500 miles from its source. At Minneapolis it plunges over the Falls of Saint Anthony, and for a little way the waters become a thunderous, roaring torrent. Then it calms down again and commences its steady flow southward. From time to time it is joined by other streams of varying size.

Between the sturdy bulwarks of the Minnesota and Wisconsin bluffs, the river makes its way, clear and swift and cool, unmuddied by the tearing of the banks on the broader river below. Farther downstream, the bluffs are wider apart, and the river swings first against one and then against the other. The wooded banks give way to the beautiful, rolling farm lands of Iowa, and at Keokuk there is a great dam to supply hydroelectric power. Between Muscatine, Iowa, and Hannibal, Missouri, hundreds of thousands of acres of rich corn land line its banks. At Hannibal, besides the growing river, we come to the country of Mark Twain. Here great rugged bluffs rise along the water's edge, and beyond the green pastures roll away to the hill country inland, where there are farmhouses and churches and patches of woodland. The house in which Mark Twain grew up, at Hannibal, is now a shrine visited by many people every year, and there are many places that bring to the visitors memories of the adventures of Tom Sawyer and Becky and Huck Finn.

"BIG MUDDY" OVERTAKES THE MISSISSIPPI

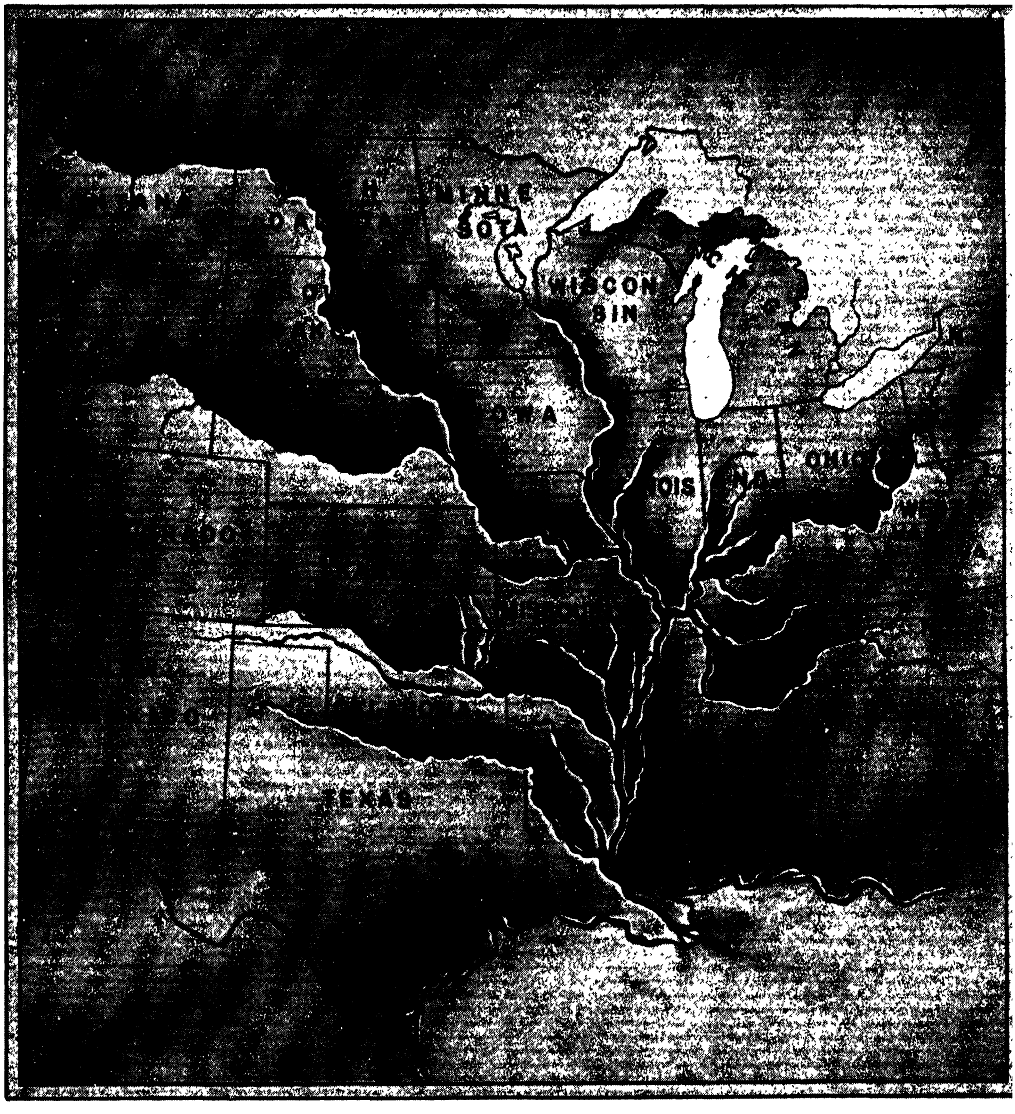
About twenty miles above St. Louis, one of the great gateways between East and West, the Mississippi receives the swift, muddy, red waters of the enormous Missouri —a larger river than the Mississippi itself at the point where the two streams join. Farther down, where the states of Kentucky, Illinois and Missouri join, at Cairo, Illinois, the Ohio River from the East flows into the Mississippi. From here on to the Gulf, the river is generally higher than the land a little way back from its banks. It has built a bed and banks for itself out of the vast quantities of mud, sand and silt its tributaries have brought it. For the rest of its journey to the Gulf it is a capricious, treacherous stream which costs the country millions of dollars each year in flood losses and in the continual struggle to control its destructive tendencies.

On a map of the United States the river appears to follow a straight course southward. Actually the stream writhes and turns like a snake, and there are very few miles in which there are no bends or horseshoe turns in the river. The currents are strong and treacherous, and the stream is forever eating away its banks, undermining them and causing great pieces of land to crumble into the swift, silent current.

LEVEES CHECK THE SURGING WATERS AND PROTECT THE BANKS

In order to keep the river under control and to save the lands on either side, banks of earth, rock and sometimes concrete have been built alongside it. These are called levees (pronounced to rime with heavy). When, however, the great tributaries are swollen with floodwater, from the rains and the melted snows of the north, they bring so much extra water into the Mississippi that it is frequently impossible to prevent the stream from overflowing the levees. When the big river overflows, all of the little creeks and streams that flow into it are backed up for miles around, and overflow their banks too. This writer has seen the river below Cairo when it looked like a shallow sea reaching in all directions, with telegraph poles, trees and houses sticking up forlornly from midst the muddy depths.

Once, in the year 1811, a series of earthquakes in the river bed near New Madrid, Missouri, caused the river to run backward upstream. The floods that this caused broke through the banks at one point and created Reelfoot Lake in Tennessee. When the waters receded, the Mississippi had a new channel at that point and Reelfoot Lake remained. It is today a famous place for game birds and other kinds of wild life.



The snows of the Rocky Mountains, the little springs of the Appalachians, the icebound lakes of Minnesota, all find their way into the great trough of the Mississippi and are carried downward to the Gulf of Mexico. This map may give you a more vivid idea of the size and extent of the territory that is drained by the river.

One of the ways in which the river is kept more or less under control is by means of "mattresses" of woven willow branches which are placed on the bed where the sharp currents gnaw at the banks. The sediment from the river quickly packs into

THE SOURCE OF THE MISSISSIPPI

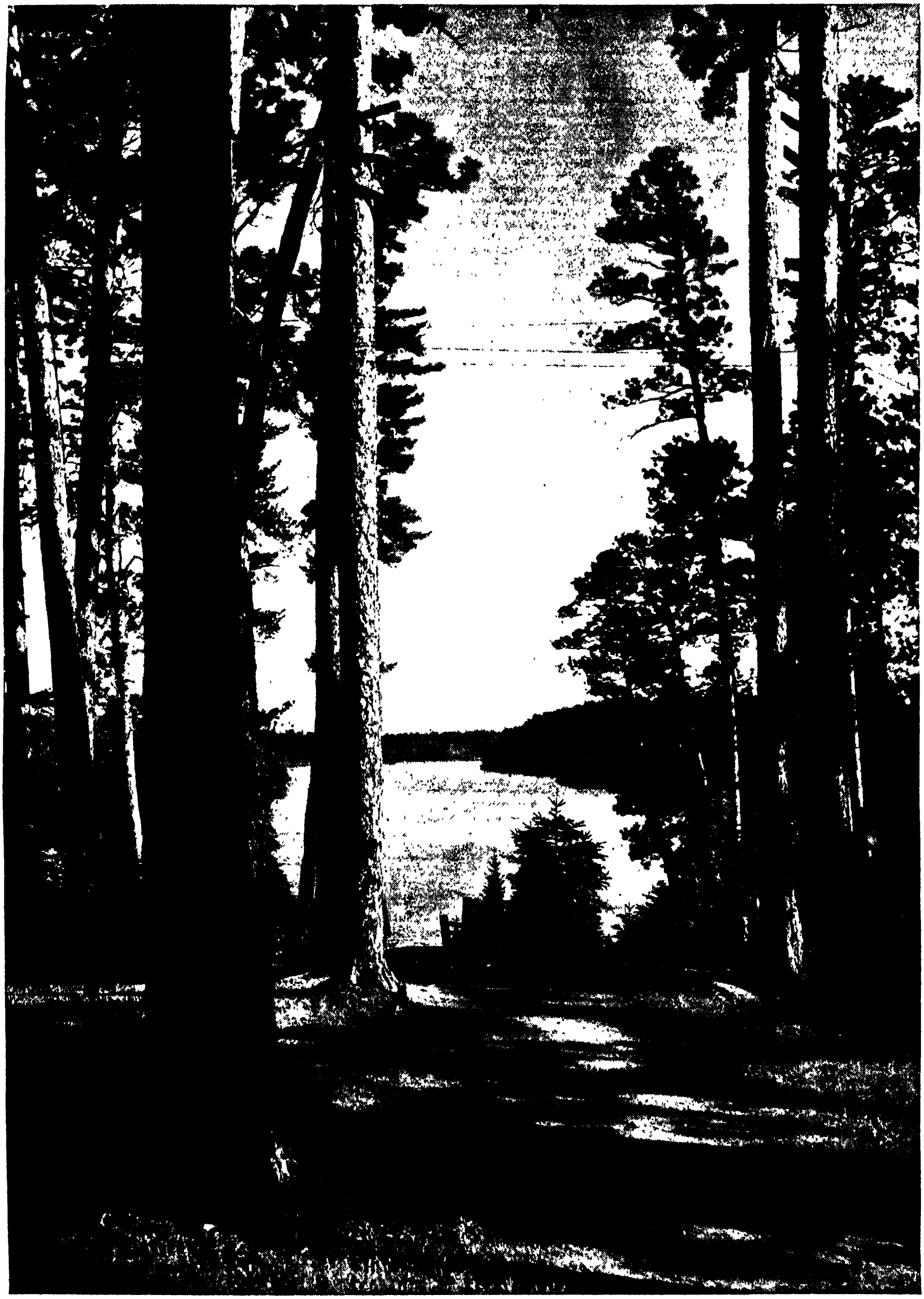
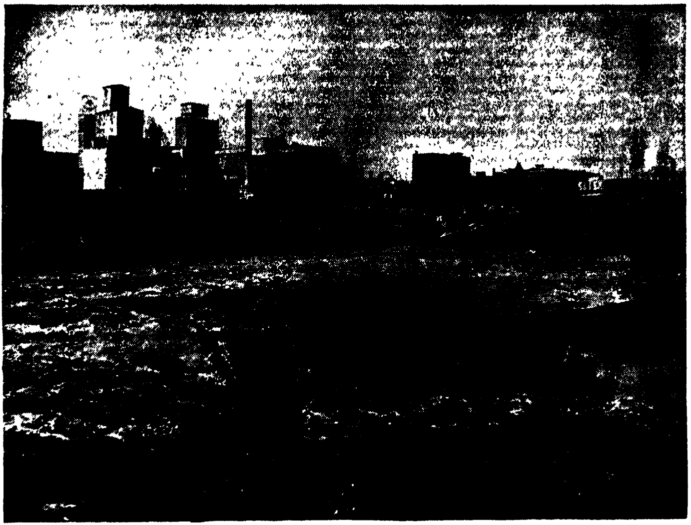


Photo by Kenneth M. Wright, St. Paul

Norway pines fringe the shores of Lake Itasca, in northern Minnesota. This is where the Mississippi begins.

SCENES ALONG THE UPPER RIVER



Minneapolis Civic & Commerce Association

At Minneapolis the river hurls itself over the rocky ledge that forms the Falls of St. Anthony. This is the head of navigation on the river, for boats and barges can not pass beyond the falls. River traffic ends here.

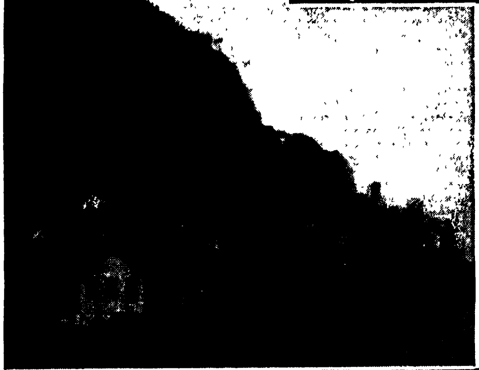
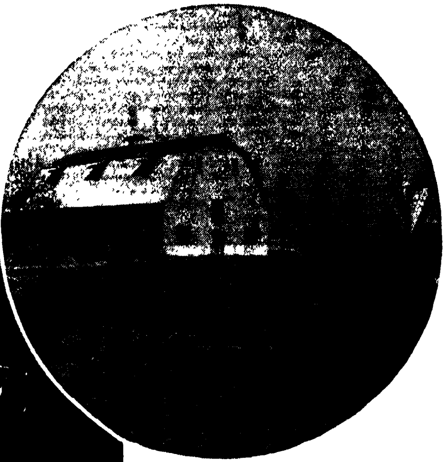


Photo by Kennth M. Wright

One of the many little towns that nestle among the bluffs and hills along the course of the Upper Mississippi River.



Hannibal Chamber of Commerce

A model dairy farm on an experimental farm near Hannibal, Missouri. This is a fertile and highly developed farming and dairying country.

St. Louis Chamber of Commerce

The business and shopping district of St. Louis. In the background is the Mississippi River with the Eads Bridge which connects Missouri and Illinois.

these mattresses and helps them to resist the action of the water. Other mattresses, some of them 2,000 feet long and 300 feet wide, are placed in such a way as to regulate the main channel. These mattresses are weighted with quantities of stone rubble. Dredging goes on all of the time to keep the channel from silting up. The states and communities along the river do a certain amount of work on the banks, but the job of controlling this great stream is a national one, and it is being carried on under the Federal government. Some day, it is hoped, a system of overflow dams and reservoirs will be completed on the great tributaries, especially the Missouri, so that the flow of the whole river can be regulated. When this has been done there will no longer be such floods as that of 1927, the largest and most destructive in the river's history.

To one class of dwellers along the Mississippi the floods hold no terrors. These are the boat-dwellers. For them the river is a great ever changing highway, full of adventure and the source of practically everything they need to live their chosen life. From the logs and planks that float on its surface they get the material to build their rafts and shanty-boats. Other floating objects furnish them with a variety of useful articles, and they earn their living in the many activities that center around the unceasing traffic of the great river highway. From St. Paul all the way to New Orleans you can see the homes of these water gipsies. Sometimes they are grouped in flotillas, sometimes alone or in groups of two or three. The boats are of every size and shape, from a skiff with a canvas cover to a large and comfortable houseboat.

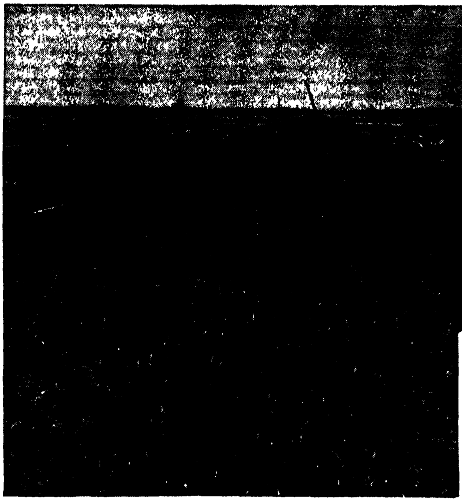
After the river passes Cairo it flows between Tennessee and Kentucky to the east, and Missouri and Arkansas to the west, and it begins to pass through the cotton country. At Memphis it flows below the city, which is built on high bluffs, but on the Arkansas shore the land is low and flat. Below Memphis it forms the boundary between the states of Arkansas and Louisiana on the west, and the state of Mississippi on the east. The Yazoo, the Red, the Saint Francis, the White and the Atchafalaya rivers flow into the big river, and in its lower reaches the surrounding country is almost tropical. The river twists along, and from the upper deck of a boat paddling downstream you can see the many-colored water birds in the winding swamps behind the levees, and tall cypress trees hung with Spanish moss and rising out of a tangle of undergrowth, or out of the dark waters of the swamp itself.

Around Natchez you catch glimpses of the

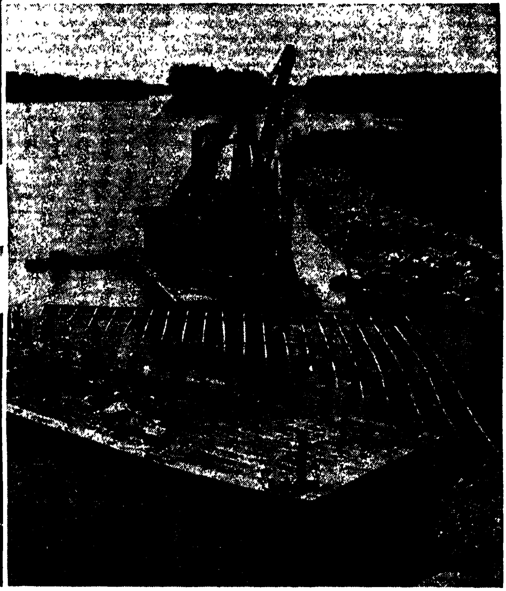
War Department, Office of Chief of Engineers

The Father of Waters goes on a rampage. This scene at Claryville, Missouri, is typical of the flood areas.

FLOOD PROTECTION ON THE MISSISSIPPI



To the left is a newly finished grass-covered levee near Harrisburg, Illinois. Levees are usually built some distance back from the river bank. The river can overflow its banks for a certain distance without danger.



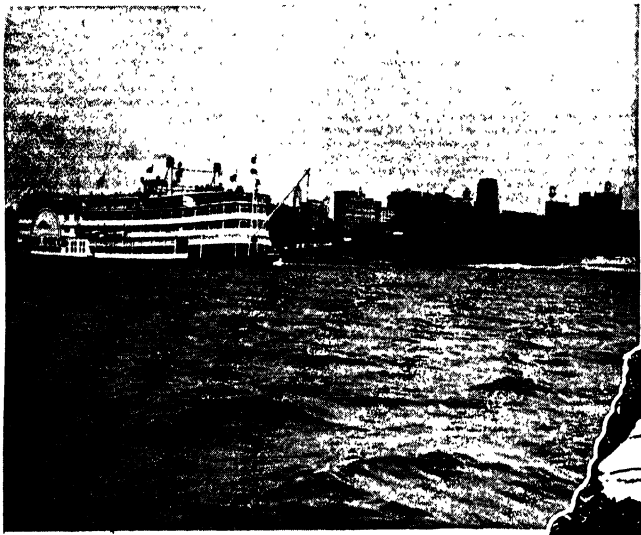
Sinking a mattress. It will be weighted down with rock.

An embankment and gateway with a storage house beneath the embankment. The scene is on the land side.

Right: another view of mattress construction. These mattresses of willow, covered with rocks, keep the current from gnawing out the under side of the bank.

Pictures courtesy, War Department, Office of the Chief of Engineers

IN THE LAND OF COTTON



The waterfront at Memphis, Tennessee, with the river steamer, Island Queen, in the foreground. Memphis is the largest inland cotton market in the world.

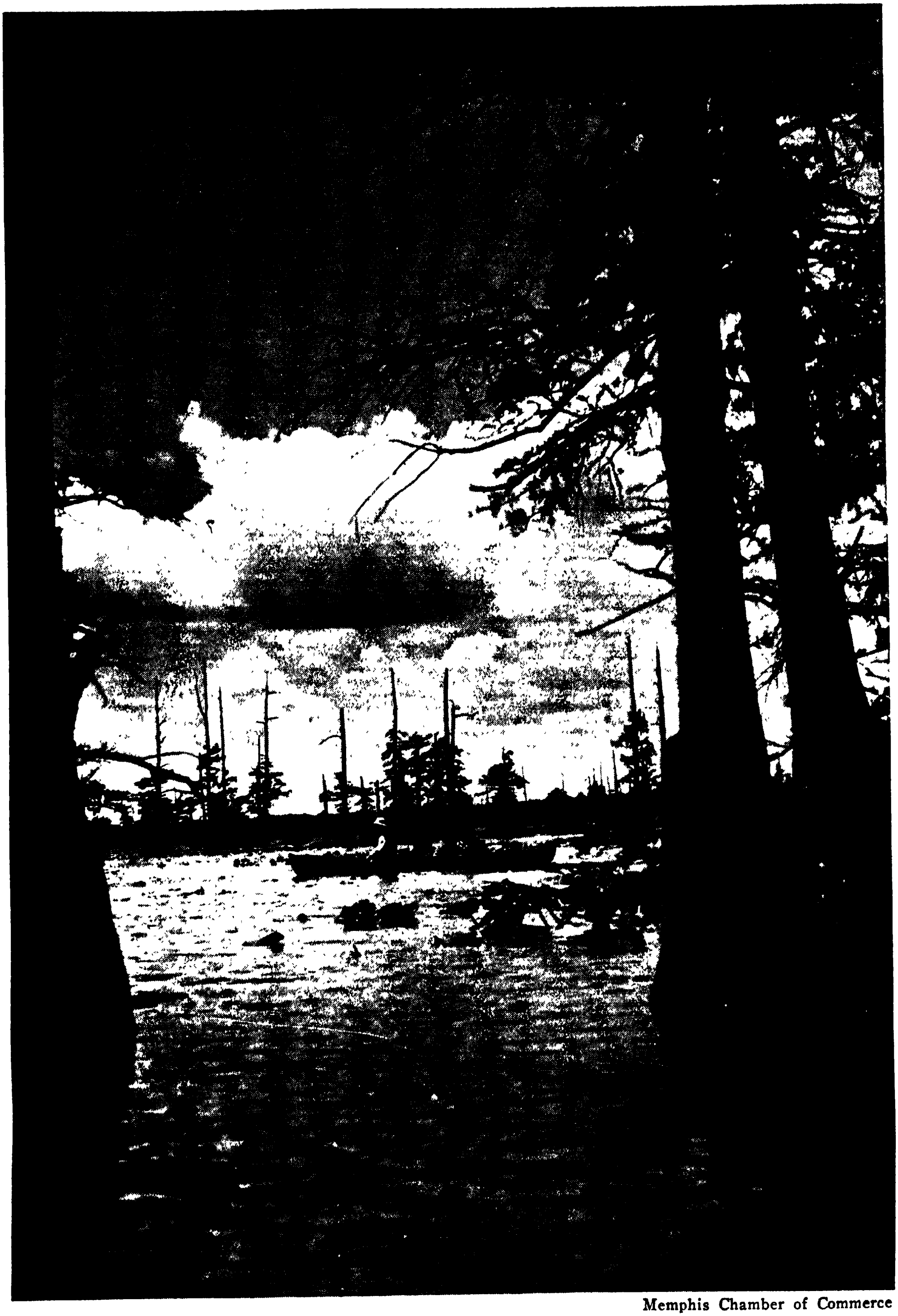
With bale-hooks and trucks, the roustabouts shift the bales of cotton from wharf to boat. Each bale weighs five hundred pounds.

Tobacco buyers examining samples at a tobacco auction in Tennessee. Tobaccoland includes part of Tennessee and almost all of the state of Kentucky.

Autumn in the fields of the Lower Mississippi Valley, "When the frost is on the punkin' and the fodder's in the shock."

All pictures courtesy, Tennessee Dept. of Conservation

THE LAKE THAT AN EARTHQUAKE CREATED



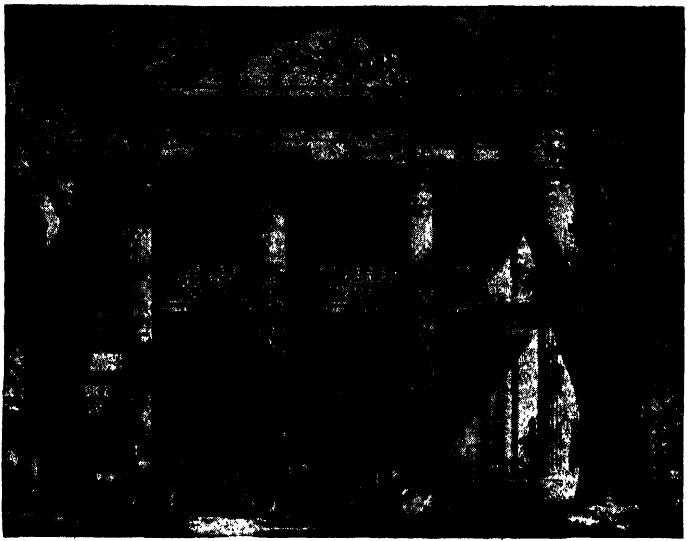
Memphis Chamber of Commerce

Reelfoot Lake in Tennessee is a sportsman's paradise. Note the big cypress trees rising out of the water.

THE LAND OF ROMANCE

Natchez Association of Commerce

Stanton Hall, one of the old mansions of Natchez, Mississippi. It is now kept as a museum by the Pilgrimage Garden Club, and is a remarkable example of luxurious life in the "Old South"

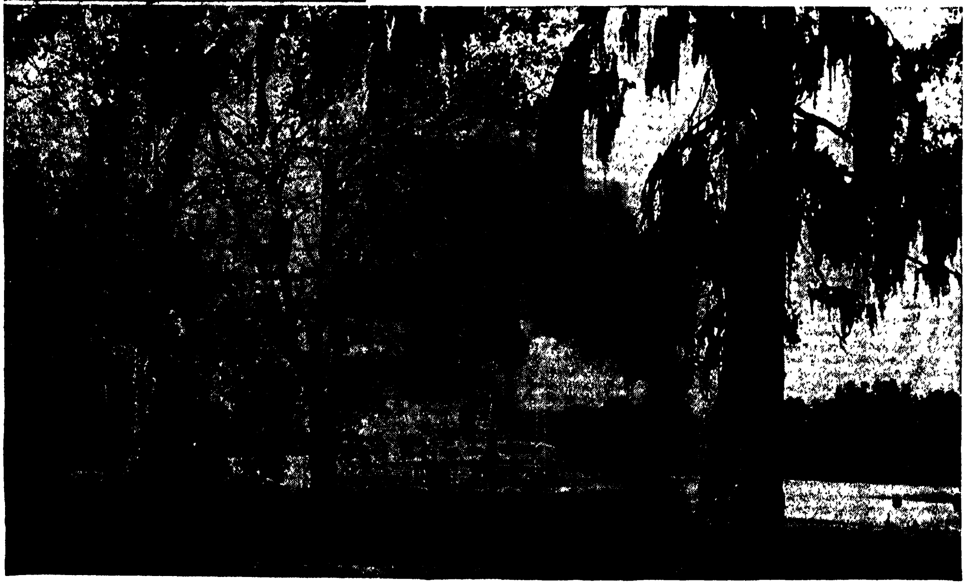


Arkansas State Publicity Dept.

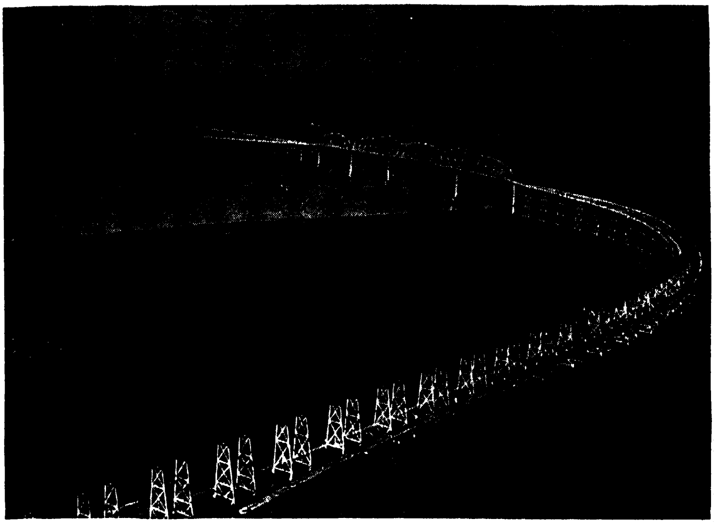
A close-up view of cotton picking. Although a number of mechanical pickers have been invented, they are not always as satisfactory as hand-picking.

New Orleans Association of Commerce

A romantic and picturesque scene on the lower Mississippi. You can not see such boats so often nowadays, since much of the cargo is carried by big barges.



THE CRESCENT CITY, NEW ORLEANS



Louisiana Bureau of Publicity

The Huey P. Long Bridge over the Mississippi River at New Orleans, the longest cantilever bridge in the world. There are now many bridges over the Mississippi River.

Resettlement Administration

A Mississippi steamboat tied up at a wharf.

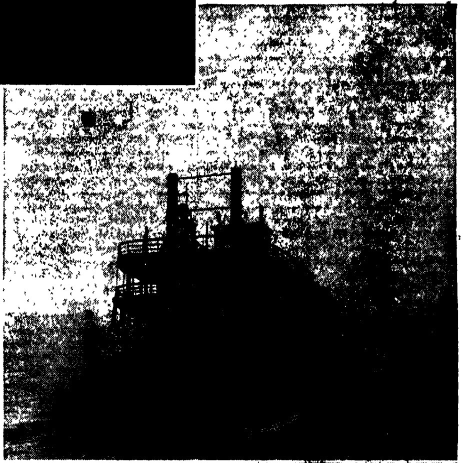


Photo by H. J. Harvey

Jackson Square in the old French quarter of New Orleans, and the Cathedral.

grandeur of the days before the Civil War, in the big plantation houses with pillared galleries and luxuriant gardens. Some of these old houses are in a state of ruin, but others have been restored and are beautiful indeed. In the spring people come from all over the continent to visit the wonderful gardens of this quaint old city.

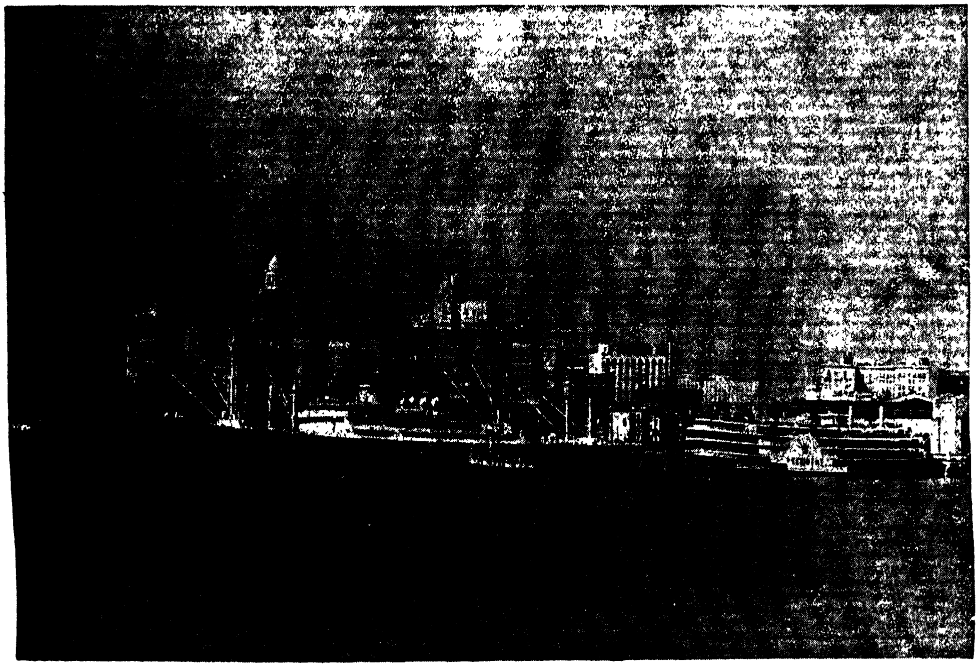
As the river nears New Orleans the influence of the French and Spanish settlers of Louisiana becomes ever more noticeable in the houses and other buildings on the shores, but there is a great deal of modern bustle along the great river. There are pretty white villages nestled among tall trees, with the broad acres of sugar and rice fields rolling into the distance beyond them.

At last the great river curves around the high-built levees and wharves of New Orleans, the Crescent City. Like New York, New Orleans is one of the great commercial gateways of our continent. Even the river itself seems dwarfed by the huge steamers that plow its dun waters. Old, bulky ferry boats, big river dredges, fruit vessels from the West Indies, Central and South America, make their way to and fro. Long Diesel-powered barges that have come all the way from Pittsburgh, or from the Great Lakes through the canalized Illinois, carry coal and iron and steel or grain, to be shipped by sea to a hundred ports around the world. River steamers piled high with cotton bales covered with dirty gray-brown burlap tie up at the wharves, which are also loaded with tobacco hogsheads, sacks of raw sugar, oozy barrels of molasses and a thousand other things.

Five miles from the Mississippi at New Orleans is a large salt-water lake, Lake Pontchartrain, which has outlets through Lake Borgne and Mississippi Sound to the Gulf of Mexico. Canals to the heart of New Orleans enable vessels to make a short cut through the lake to the Gulf.

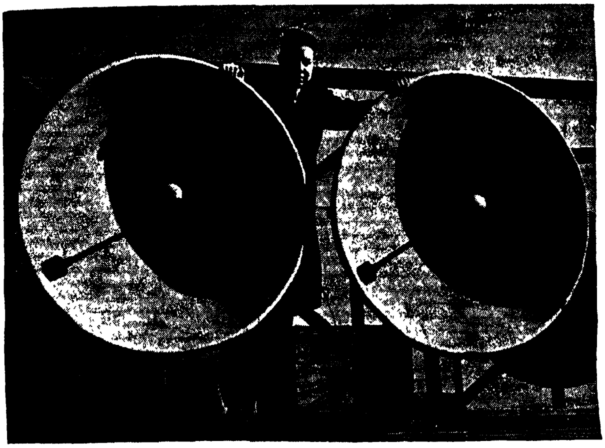
The metropolitan area of New Orleans has more than 540,000 people. The city is not at the end of the river, but about a hundred miles upstream. The river sweeps by the city and gradually loses itself in the low islands and swamps through which it finally reaches its many mouths and empties into the Gulf. All of this low land has been built up by the Mississippi River itself, from the silt that it has been carrying down through the heart of the continent for long centuries before the memory of mankind. If Old Man River keeps building out into the Gulf he may, in time, fill it up.

THE NEXT STORY OF THE UNITED STATES IS ON PAGE 6207.

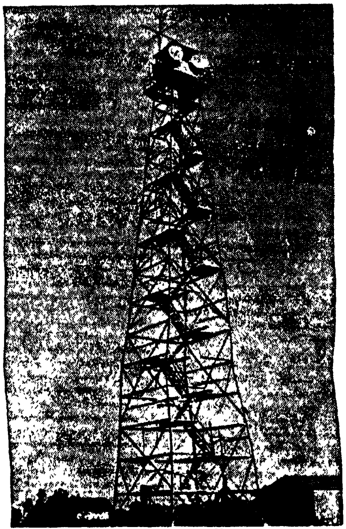


New Orleans Association of Commerce

The skyline of New Orleans, seen from the Mississippi River, which curves around the city in a great crescent.



Reflectors relay telegrams from one radio beam tower to another.



Photos, courtesy Western Union

Radio beam telegraph towers, spaced from 15 to 55 miles apart, can be used instead of wires to relay telegrams.

HOW WE SEND a TELEGRAM

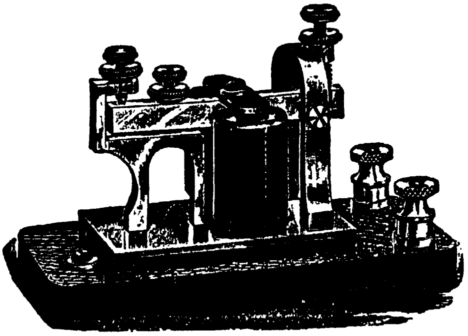
ALL that you have to do if you want to send a telegram is write out your message and give it to the person at the telegraph office. You can take it there, or call for a messenger to take it, or you can telephone it to the telegraph office, in which case the telegraph company will have the telephone company charge you for it on your telephone bill. It is as convenient as that.

"A telegram for you, sir!"

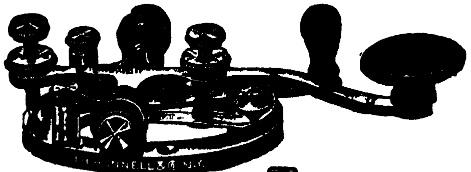
When your telegram reaches the town to which it has been sent, it will be delivered by a messenger. Sometimes, to save time, the telegraph office at the receiving end will read the message to the person for whom it is intended over the telephone, and then send a typewritten copy along later. So far as the sender or the receiver of a message is concerned, it is quite as easy to send a message around the world as to send it to a neighboring town.

To the people who operate the telegraph systems it is not so simple to send and receive messages. What takes place between the sending and receiving offices may involve the use of the simplest form of hand-operated electrical instruments, or for long-distance messages it may involve the use of wires and submarine cables, or of radio or wireless, or a combination of these. Large city offices handle a vast number of messages, and most of the long-distance messages are handled from and through the large cities; and in these offices there is complicated and delicate electrical apparatus, switchboards and other devices.

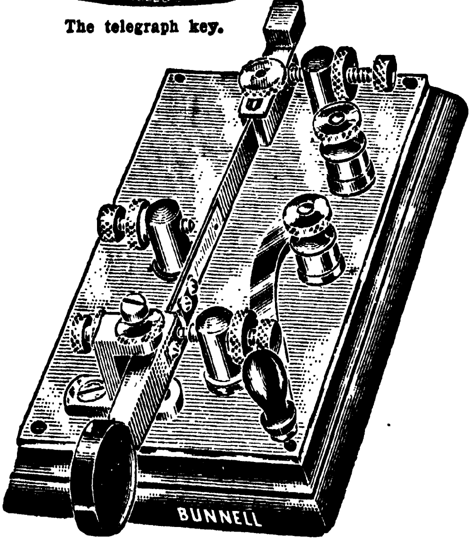
In the process of sending telegrams most of them are changed into what is known as a telegraph code. These are usually written as dots and dashes . . . — — —, but modern operators call the dots dits, and the dashes dahs. Listen to a message as it comes in



The telegraph sounder.



The telegraph key.



Photos, courtesy, J. H. Bunnell & Co.
This key moves sideways. It is nicknamed the bug.

over a wire in a small railway station, and you will notice that it sounds like dit dit dah dit dah dah dah. Combinations of dots and dashes, or of dits and dahs, stand for letters of the alphabet, figures and sometimes even whole words and sentences. The dits and dahs represent long and short electrical waves or impulses sent over the wires. When these code signals come in over the wires to the receiving office they are changed back again into ordinary language.

In principle the electric telegraph is much the same as it was when first invented, more than a century ago, and the original code is still in use. Wonderful changes have been made to increase the speed at which messages can be sent and delivered; to change messages more quickly into code and back again after they are received; to increase the number of messages that can be sent in all directions at the same time; and to increase the distance over which messages can be sent. To do these things complicated devices and improvements have been continually made since the first telegraph was invented.

We tell about the invention and development of the telegraph, telephone and radio in another chapter of THE BOOK OF KNOWLEDGE, and there are other articles on Electricity, Cables and Radio. All of these articles are of interest to anyone who wants to know about the telegraph, because nowadays the sending of telegrams makes use of all means of electrical transmission.

The oldest and most familiar use of the electric telegraph has been for sending personal and business messages. Almost as great is its use by railroads for "train dispatching," that is, for regulating the movements of trains. Telegraph poles are strung out along every railroad line to carry the wires that are used by the railroad, and also the wires of the commercial telegraph companies, such as Western Union. The telegraph operator in small railway stations usually sends and receives messages for private persons as well as for the railway company.

THE NEWSPAPER COULD HARDLY EXIST WITHOUT THE TELEGRAPH

The most extensive use of the telegraph today is for gathering news and other information for the newspapers, so that events occurring all over the world may appear in our newspapers the same day or early the next morning. The principal daily papers in most countries are members of great news-gathering associations, such as the Associated Press, Reuters or the Canadian Press. Local news gathered by a newspaper in its own area is also telegraphed to the central offices of the association it belongs to. At these offices the news is sent out over the wires of the press association, or over leased wires, to hundreds of newspapers, all at the same time. Within a few hours (often within a few minutes) after the President of the United States or the Premier of Canada makes an important speech, or after any important event, all the newspapers in the United States and Canada, and many in other parts of the world, may have the news to print, for immediate distribution.

In our daily papers there are columns of stock-market reports and also prices of commodities, such as wheat, cotton, corn and so on. These reports go out all during the day, and in a short time after the closing of the markets a complete list of many hundreds of final prices has been received by the newspapers.

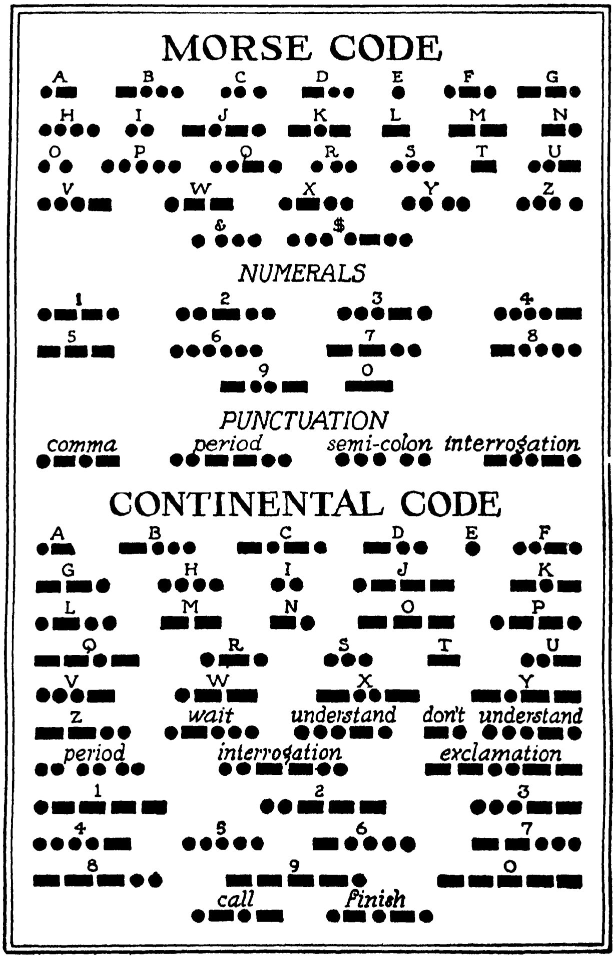
The Government is an extensive user of the telegraph for gathering weather information and sending it out with weather maps to all parts of the country. The Government also sends out official announcements, orders and important information of all kinds to be widely distributed in this way. The sending and receiving offices of the submarine cable companies and the transocean wireless telegraph companies are "bottlenecks" through which thousands of messages must pass every twenty-four hours.

All of this will give you some idea of the enormous use of the telegraph. Now we shall tell how these messages are sent. The simplest way of sending messages today is by hand-operated instruments, usually in small or local offices, for short distances. The operator has a sending instrument, or key, and a receiving instrument known as a sounder. There is an electric battery which furnishes the current.

The key is really a form of switch; the wires leading from the battery to the outside transmission lines are attached to it, and this key is used to make or break the connection in the wires through which the current flows. There are two kinds of keys in general use. In one you press down a flat knob to make the electrical connection; a spring lifts the key when you stop pressing and breaks the connection. Another form of key, nicknamed the bug, serves the same purpose, but is moved sideways to make the connection, and springs back to open the circuit when pressure is released. It is claimed that the bug form of key is less tiresome to the operators, who sometimes get cramped wrist from continual use in sending messages. Working the key takes considerable muscular control.

The "rest" position of the key gives an open circuit, that is, no current flows through the wires. When the key is pressed it closes the circuit, and the electric current flows through the wires to the distant receiving station as long as the key is pressed. The instant the key is released no more current is sent out. In this way, short and long waves, or impulses, of electric current can be made to flow over the wires. This is just the same as when you press a button to ring an electric bell: a quick pressure gives a short ring (a dit), and a longer pressure gives a longer ring (a dah).

Other systems use a key which interrupts the flow of current when it is depressed. In the "rest" position, then, the circuit is



Most telegrams sent over long distance lines are transmitted by the multiplex system. As many as 8 telegrams are sent and received at the same time over one wire. The girl in the foreground has just received a telegram and is gumming the message on the telegraph blank. The girl beside her is sending a telegram to a distant city.

Photos, Western Union

You do not have to leave your home or office to send a telegram. Just pick up your telephone, call Western Union and dictate your message to one of the recording operators. These girls are writing telegrams that have been dictated over the telephone.

closed and current is flowing through.

Electricity moves, or flows, at the rate of speed of light; that is, at 186,300 miles per second; and for the distances over which we telegraph, the current reaches the receiving station at almost the same instant it is sent out. The receiving instrument, or sounder, has what is known as wire-wound magnets; and the incoming current, flowing through the wires of the magnets, sets up a magnetic pull which moves a small metal bar toward the magnets. The bar is on a hinge. When it is pulled to the electromagnet, it clicks against a metal stop. When the current is broken at the sending end of the wire, electricity stops flowing through the magnet and the magnetic pull ceases. The metal bar then springs back to its original position and strikes against another stop. These clicks are the dits and dahs that you hear, a click at the beginning and a click at the end of a signal. The space between the clicks tells the operator whether a signal is a dit or a dah.

The original idea of Morse, the inventor, was to have a narrow paper tape move under the free end of the bar, which had a self-inking pen attached to it. When the bar came down and was released quickly, the ink made only a dot on the moving tape. If the bar was pressed down a longer time the pen would make a dash on the moving tape. The object of this device was to make a code of dots and dashes which would stand for letters of the alphabet. Morse invented a code which we show on page 6051. Other codes have been invented, but none has been simpler or more satisfactory for most purposes than the original code Morse worked out.

After the telegraph came into general use the operators discovered that, from constant hearing of the click of the instrument, they could readily tell a dot from a dash by the length of time between the click when the bar on the receiving instrument went down and the second click when the bar sprang up against its stop. So it became no longer necessary to use the recording tape on the receiving instrument of hand-operated systems. The receiving instrument became known as the sounder.

THE TELEFAX AND THE TELEPRINTER

Many large companies are equipped with teleprinters. These machines save the customer's time and enable him to receive his messages at almost the same moment they are received in the telegraph office. The teleprinter in the customer's office is connected by direct wire with a similar machine in the city telegraph terminal. Most branch telegraph offices are also operated by the use of teleprinters. These girls are operating the teleprinter in a branch office.

Photos, Western Union

Telefax makes it easy for you to send a personal message. Its name comes from the two words telegram and facsimile. To send a message by Telefax you write or type your message and drop it into the Telefax transmitter, as this girl is doing. When the message arrives at the other end of the wire it is an exact copy, or facsimile, of your original message. You are thus able to send to your friends "handwritten" telegrams. Since Telefax makes an actual copy of the original message, the possibility for error is very slight. Telefax can be operated over the radio beam telegraph system as well as over the regular wires. It has proved valuable to railroads. The local dispatcher can tell crews at points along the rail route where to pick up and set out cars on sidings. Telefax has a wide use, not only in the transportation field but also in other lines of work requiring rapid and accurate means of transmitting instructions, documents, and so on.

We see from this that letters or words themselves do not go over the simple telegraph as they do over the telephone or radio. What goes over the telegraph wires is simply a series of short and longer impulses of electric current.

The recording tape, though no longer needed for hand-operated systems, came back into use again in more elaborate systems. With the development of devices for rapid sending of many messages, and for long-distance telegraphy by submarine cables and wireless, recording tapes became a necessity, and we shall tell more about them a little farther on.

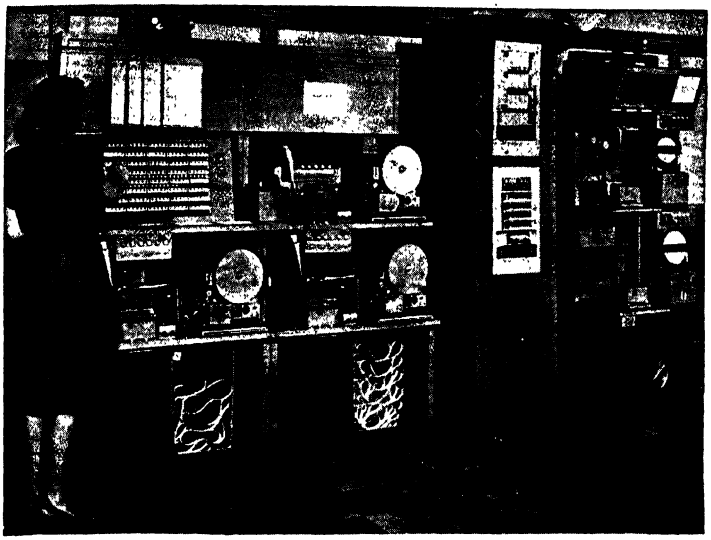
In hand-operated telegraphy there is a limit to the speed at which a man can tap his key. If very skillful and enduring, he may be able to send as many as forty words a minute. An average speed would be about twenty-five. With the hundreds of thousands of messages now sent out every day, and the immense amount of news and other messages sent by wire, hand-operated telegraphy could take care of only a small fraction of the work. The system of hand-operating is now confined chiefly to short circuits, or to lines that act as feeders to the longer trunk lines. Between larger cities and for long-distance telegraphy there are high-speed systems that send many messages over the same wire and use automatic printing devices to record the messages. Anyone who can learn to use the typewriter can act as sending operator, and at the receiving end the message comes out printed in the ordinary letters of the alphabet.

Soon after the telegraph came into use men began to work on inventions which would print the message received in the usual letters of the alphabet, or telegraph printers, as they are called. Telegraph printers, by means of clever electrical devices, translate the dots and dashes into letters or figures and print them on the moving tape of the recording instrument. It takes several years of training to make a fast telegraph hand-operator. With a printing device on

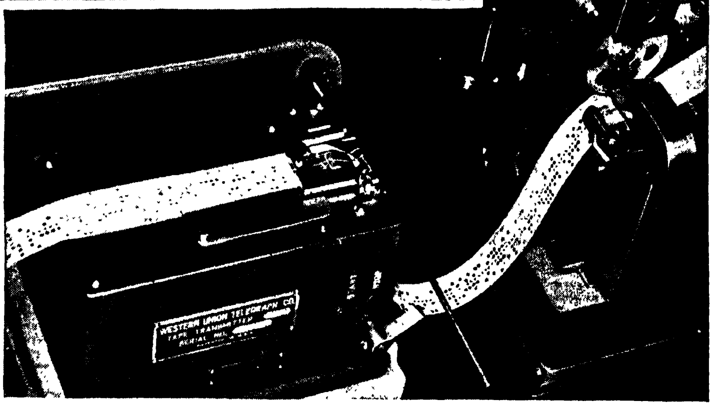
Western Union

These men are operating the telegraph carrier system. By it they can send many messages at the same time.

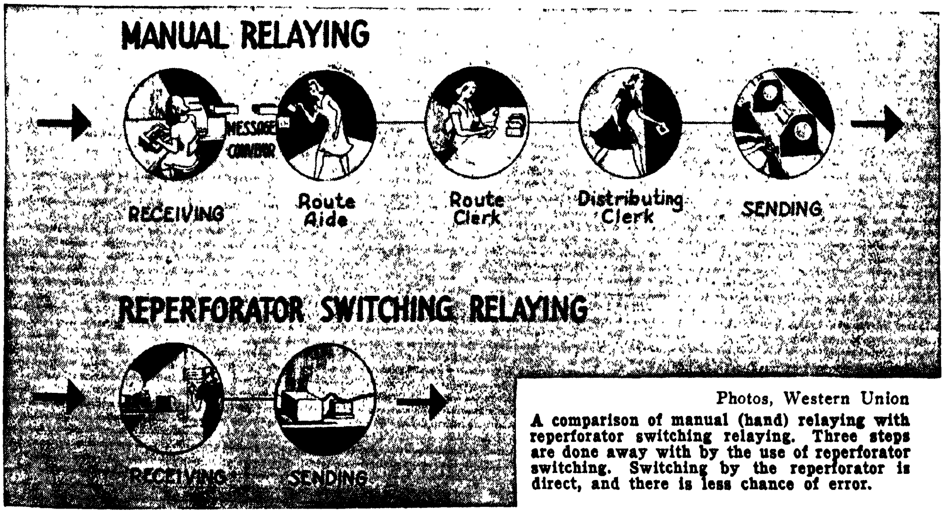
MACHINES THAT ALMOST THINK!



One unit of the reperforator switching system. By means of this system telegrams are relayed automatically through key cities. A message arrives in a city office. A girl presses a button. The message is switched from one telegraph line to another and goes on its destination in another city without delay.



Here is how the relayer works. Incoming messages are recorded on a tape like the one at the right. A coded perforation is made on the tape for each letter or figure. To make it easier to read the tape, the letter or figure is also printed above each perforation. The tape passes from the perforator to a transmitter where it is automatically relayed to its proper destination. It arrives in printed form.



Photos, Western Union

A comparison of manual (hand) relaying with reperforator switching relaying. Three steps are done away with by the use of reperforator switching. Switching by the reperforator is direct, and there is less chance of error.

the receiving end a trained operator is not needed to receive messages. A printing receiver could also print messages many times faster than they could be sent by hand-operators at the other end of the line. So, the next step was to invent a sending apparatus which could send messages much faster.

CLEVER INVENTIONS INCREASE THE SPEED OF SENDING MESSAGES BY TELEGRAPH

This was done by having a machine that looks very much like a typewriter, with much the same kind of keyboard. The keys standing for letters of the alphabet, etc., do not print letters as the typewriter does, however, but operate an electrical device through which a narrow paper tape passes. This device has five small punches which punch holes in the tape as it passes through. For each letter of the alphabet, or other character, it punches a certain number of holes, spaced differently. After a message has been punched in this way on the tape, the tape is fed into a transmitting machine. It is through these groups of holes in different patterns that the electrical contact is made and broken at short and long intervals, and the electric current goes through the wires in broken impulses similar to those of the hand-operated sender. As we have seen, these impulses operate the typewriter printing machine at the receiving end.

One pressure on any letter of the sending keyboard punches a group of holes corresponding to that letter. With a hand-operated key, an operator had to make, on the average, about three separate pressures of the key to make one letter. Thus a person operating the mechanical sending device, instead of sending out about twenty-five or thirty words a minute, can send out more than a hundred words a minute.

These sending and receiving devices will transmit messages much faster than one operator can punch them out on the machine, so the tapes of several operators, each tape having a number of different messages on it, are fed, one after the other, into the transmitter. The transmitter is then speeded up so that many hundreds of words per minute can be sent out over one wire. These sending and receiving printing machines are now the main equipment of all large telegraph offices.

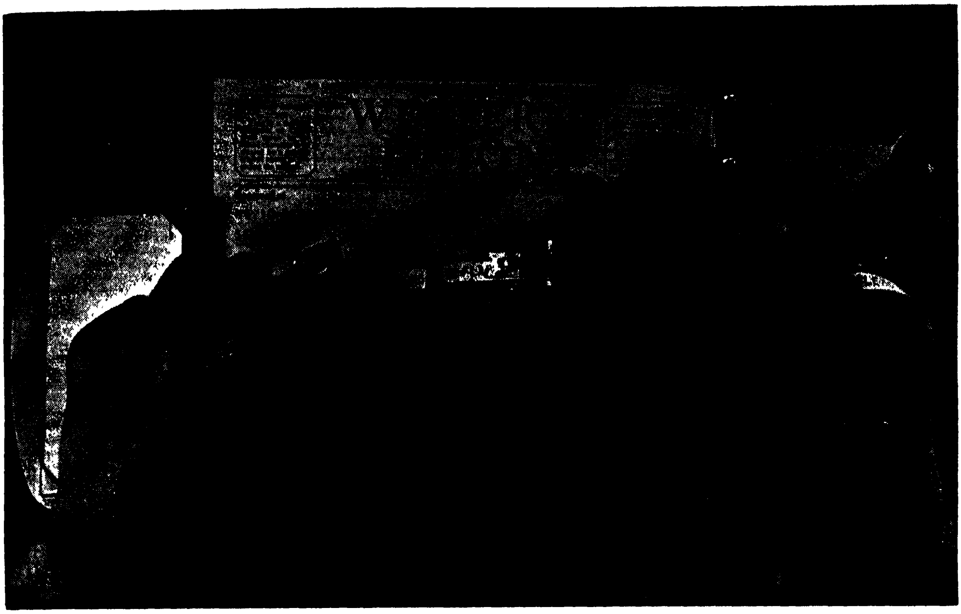
The next great invention was to increase the capacity of the telegraph, so as not to have to build more lines. This invention is called the multiplex system. By means of it as many as eight different messages can be sent over one wire at the same time, four in one direction and four in the opposite direction. We must remember that the action of electricity is practically instantaneous and can be controlled with the greatest accuracy. The apparatus for sending and receiving these multiplex messages keeps the impulses from interfering with one another; and when the messages reach the receiving end, each one is separated from the others by a receiving device and guided to its own particular printing machine. This system is of immense advantage to the larger offices, especially in the big cities. More than five hundred messages per hour can be handled over one line. Another device makes it possible to telegraph messages over a telephone wire without interfering with the talking that is going on over the same wire, thus giving still another network of wires and cables for telegraphing.

A variation of ordinary telegraphy is called carrier telegraphy. Here as many as thirty-six separate musical tones are sent over a pair of wires at the same time. Each tone, or frequency, carries a stream of telegrams. The coding effect is produced by varying the tone of each individual frequency, according to the letters of the message. The latest of these systems provides for as many as 288 telegrams to be sent simultaneously over a pair of wires.

THE SAME MESSAGE CAN BE SENT TO MANY CITIES AT THE SAME TIME

In 1942 the Western Union Telegraph Company announced a new device which automatically sends the same telegram to thirty-six key cities at the same time. The device, in the telegraph offices of these key cities, can send the message on to a number of other cities. Before this system was developed, when a message was to be sent to a great many different addresses, it was necessary to make many copies for operators to send out separately. The new device was first used by the United States Government. It is used in sending out news dispatches to newspapers all over the country at the same time.

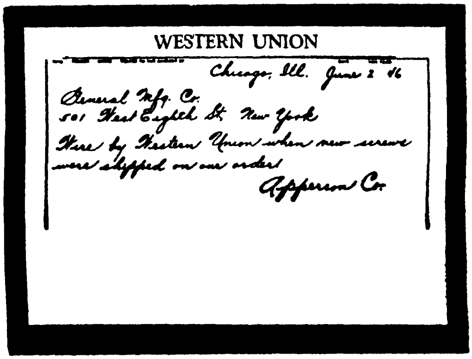
Every continent and almost every island of any size in the world inhabited by civilized people has its network of telegraph lines. To connect these land networks with others across oceans and seas has required the laying of a great number of submarine cables. Not only are cables laid under the Atlantic and Pacific oceans, but a great number pass under seas, bays and narrow waterways be-



An operator pasting a message received by the teleprinter on a Western Union telegraph blank. The message comes out of the teleprinter in long strips of tape. This is the most widely known form of the telegram.

tween land areas, such as the Mediterranean Sea, Black Sea, the North Sea, the water of the Indian Ocean, the Caribbean Sea, the English Channel and so on. There are about 450,000 miles of cables in use, so that we can send messages under the oceans and other bodies of water to nearly every country in the world.

The principle is the same as that of the land telegraph, but the wires are different, and the rate of telegraphing is slower, for the current passing through these long wires becomes weaker as the distance increases. The weaker current can not operate the machines at the receiving end so rapidly as the stronger currents can do over the shorter distances of land telegraphy. Therefore the cable receiving devices have to be much more delicate and complicated.



WESTERN UNION

Chicago, Ill. June 2 '16

General Mfg. Co.
501 West Eighth St. New York

Wire by Western Union when new screws were shipped on our order

Apperson Co.

Photos, Western Union

A message received by Telefax transmission. It is an exact copy of the original handwritten message.

Scientists have worked out many new improvements to make the sending and receiving of messages by cable largely automatic, by use of devices similar to those used in land telegraphy and by using the multiplex method of sending and receiving. Before the war a new type of cable known as "permalloy" was laid between New York and the Azores which permitted six times the speed to be obtained. To replace all of the older cables would cost hundreds of millions of dollars and would take a great deal of time. With the increasing use of wireless telegraphy across both land and sea it is doubtful if many new cables will be laid. The cable does have the advantage of absolute secrecy, for no one can tune in on a cable message. The speed of cable telegraphy has been greatly increased, but it is still not quite so great as that of land telegraphy.

Still another of the wonderful means by which messages are sent is radio, sometimes called wireless. It has been developed as a means of communication until it now links the whole world—on land, sea and in the air.

After the beginning of the twentieth century the messages which were sent by wireless were called marconigrams. Marconi was the man who invented the first wireless. Later, with the development of the electron tube by De Forest and others, the term radio became more common. Messages sent in this manner were called radiograms. In the chapter beginning on page 5033 we tell you more about the magical electron tube.

TELEGRAPH COMES TO THE AID OF SHIPS IN DISTRESS

One of the greatest blessings of radio has been that it enables ships at sea to send messages when in distress. Many thousands of lives have been saved, as well as many valuable ships and cargoes, through prompt summoning of assistance by radio. Before the development of wireless telegraphy, when a ship left harbor and was out of sight of land, nobody knew anything about it until it reached its destination days or weeks later (unless it was "sighted" by other ships). Nowadays a ship is in constant touch with land, no matter how far out on the ocean it may be. Messages can be sent to land and to other ships. The larger steamers publish little newspapers every day and even give some of the market reports, weather reports and the like.

Today there are vast networks of radio "lines" across the oceans and land areas of the world. You can send radiograms to all parts of the world just as you send ordinary land telegrams. Until recently the speed of sending wireless telegrams was slower than that for telegrams using wires; but now the methods are equally rapid, and the wireless uses automatic sending and receiving and printing devices like those we have described.

You can see from all of this that there are three great networks by which telegrams may be sent: the land telegraph network, the submarine cables and the radio network which covers the world and the air. In addition there are the great networks of the telephone, carrying words still farther. There is competition among them in some ways, but in other ways they work together as one great organization to forward messages in the best and quickest method. There are combinations, such as the American Telephone and Telegraph Company, which, by its own lines, and by working arrangements with other companies, will send a telegram for you to any part of the world. The message may go by wire, cable and wireless, and even partly by telephone, but you will pay one charge. This charge is divided among the different companies handling the message, so that each gets its proper share for the work it did.

The cost of sending a telegram is based on the number of words, including the address, signature and return address, if there is to be a reply. Night letters and certain other types of telegram can be sent at a reduced rate, as they are sent when the wires are not so busy. Every effort is made to keep down the number of words, and corporations and business houses that send many telegrams and cable messages use one "code word" to cut down the number of words in their address. For example, the word "Bonaqui" is the cable address of "The Grolier Society Incorporated, 2 West 45th Street, New York 19, New York," the company that publishes THE BOOK OF KNOWLEDGE. Here one word takes the place of thirteen. Many corporations which do a world-wide business, and also governments, have what is known as code books, something like small dictionaries, in which one or two words stand for whole sentences of the kind which are likely to be used often in their messages. All parties using such codes must have copies of their particular code.

SCIENCE SOLVES THE PROBLEM OF SENDING PICTURES BY TELEGRAPH

For many years scientists worked to make the telegraph carry pictures. The solving of this problem has not only given us television, but has also made possible the sending of pictures, photographs, and even photographs of reading matter. The American Telephone and Telegraph Company did pioneer work in this field, and the process that it developed, called Wirephoto, is used by the great news-gathering agencies, which send out pictures to subscribing newspapers just as they send out news by telegraph. Pictures taken by news photographers for one city newspaper may be sent over the wires of the press association to hundreds of other newspapers. Special correspondents in foreign countries send photographs by cable or wireless along with the news they send.

How this is done is very interesting. The sending end of the apparatus has a cylinder about which the photograph, or other material to be sent, is wrapped. It is then "scanned" by a tiny pinpoint of a light-beam. This is done by having the cylinder revolve rapidly, and the tiny light-beam

A message flies from one continent to another through one of the many cables that lie upon the ocean floor. The message enters a telegraph office and pops out of a marvelous little receiver like the machine at the left.

Photos, Western Union

A cablegram is sent to a city across the ocean. The message is first translated into perforations by a special typewriter keyboard. It is then passed through the automatic transmitter, and the message is sent through the cable lines.

moves lengthwise of the cylinder at the rate of a few thousandths of an inch for each complete turn of the cylinder.

The light-beam covers the whole area of the cylinder in a spiral path. This means that the beam passes over the surface in the same way that the thread winds around a screw or the needle of a dictaphone moves over the dictaphone cylinder. The light-beam grows strong or faint according to whether the part of the photograph it falls on is light or dark. At the same time the light is reflected on a photo-electric cell, which controls the current going out over the wires to the receiving end. The strength of the current is thus regulated by the amount of light reflected.

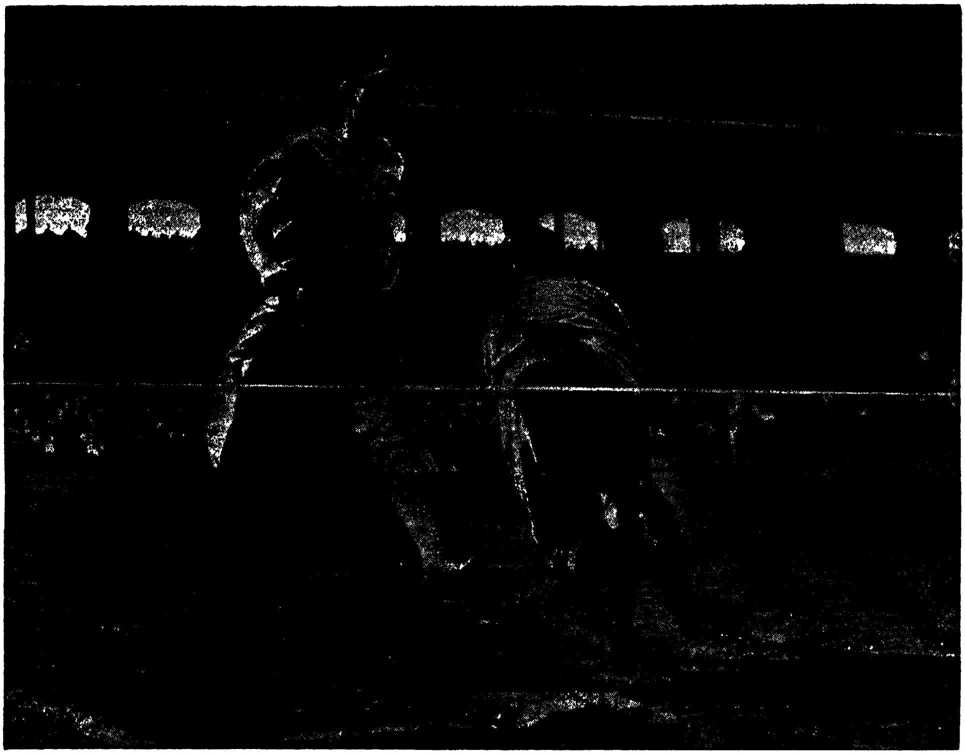
At the receiving end a photographic negative, which has not been exposed, is wrapped around the same kind of cylinder. The cylinder is enclosed in a case which permits no light to enter. As the sending cylinder turns, the receiving cylinder is set moving and turning at the same speed and in the same way. We say they are synchronized. The receiving cylinder is scanned, just as the sending cylinder is, by a tiny light-beam. Its strength is controlled by the incoming current from the sending end. We have explained how this current grows weak or strong depending on the amount of light reflected at the sending end.

As the light-beam falls on the negative wrapped around the receiving cylinder, it affects the sensitive film, line by line and, of course, at a very rapid rate. Light and dark areas appear, and all the shades in between. The film is then developed just as any other photographic film. Any number of prints can be made which will be faithful copies of the original picture.

Another means of sending messages is the Western Union Telefax, a facsimile (exact copy) sending device. It, too, makes use of the electric eye.

All that you have to do in sending a telegram by this method is write your message on a slip of paper, and drop it into a slot, just as a letter is dropped into a mailbox. (See picture on page 6053.) The machine automatically wraps the paper around a revolving cylinder in the Telefax cabinet. A photo-electric cell focuses on the handwritten message, drawing or figures, and causes electric impulses to be sent over the wires, much as in Wirephoto transmission.

At the receiving end, another machine re-



Courtesy, Associated Press

The top half of the picture shows an actual news photo. The bottom half, almost as clear, shows a Wirephoto.

produces the original message. Since Telefax does not use coding, it is possible for a friend thousands of miles away to receive a message in your own handwriting!

During the war Telefax was used a great deal in China, where telegraphing by usual methods is slow and difficult. The Chinese language does not have a simple twenty-six letter alphabet similar to the one we have in English. There are many thousands of characters which you use to write out a telegram in Chinese. So in ordinary telegraphy you must use a code with a different number for each character!

However, in Telefax transmission, it is not necessary to translate a Chinese message into code before sending it, and then translating it back at the receiving end. Instead a facsimile of the original, written in Chinese by the sender, is sent directly to where it is addressed.

Telefax machines are now employed for the transmission of telegrams between a number of telegraph branch offices and main offices, and between the offices of a number of large firms and telegraph main offices. Soon Telefax will be found in hotel lobbies, railroad stations and office-building lobbies, permitting you to send your own handwritten or typewritten telegrams as simply as letters are now dropped into a letterbox.

Newer yet is the system of sending telegrams by super-high frequency radio beams. Although it is not yet in common use, within a few years all major cities may be linked in this way, instead of by wire. Radio-beam transmission will improve the quality and speed of telegraph service, and it will be more dependable. It will reduce interruptions due to snow and wind storms which often cause telegraph lines and poles to fall.

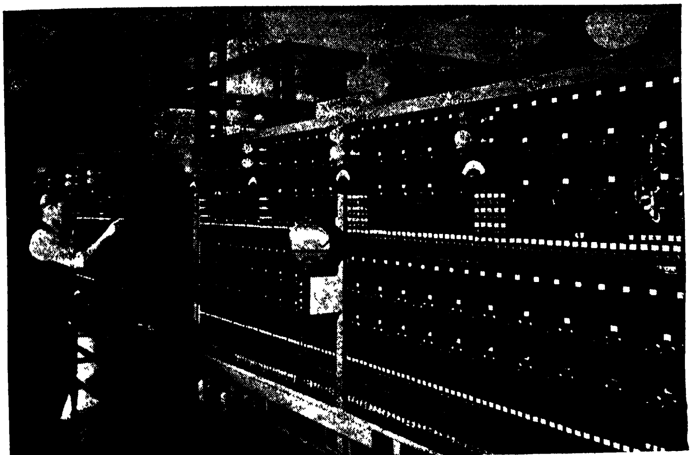
The radio beam can be equipped so that it is possible to provide 270 multigraph telegraph circuits in each direction. This will enable 1,080 operators to transmit telegrams at the same time.

Some day this radio system will probably replace entirely the familiar poles and the millions of miles of wire which make up the telegraphic networks of the world.

By E. C. McDowell, Sr.

THE NEXT STORY OF FAMILIAR THINGS IS ON PAGE 6182.

NEWS BY TICKER TAPE



Western Union

The stock ticker is a specialized automatic telegraph receiver. It brings the prices of stocks and bonds instantly from the exchanges, where they are set, to newspapers, brokers, and private offices. This is the complicated switchboard through which the service is distributed.

Trans-Lux Daylight Screen Corp.

Stock exchange quotations are thrown in enlarged characters on a screen above the ticker at the same time they appear on the ticker. This device permits everyone in the room to see the figures clearly. The stock exchange is probably the most curious market in the world.

Western Union

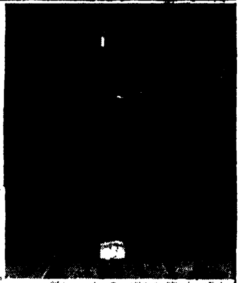
Click, click! and a few inches more of ticker tape unwinds from the machine, with another chapter printed on it... new prices of stocks and bonds, or news (if the ticker is in a newspaper office.)

THE FIGHT TO CONTROL INSECTS

U. S. D. A. photograph by Ackerman

Insects are a constant menace to the fruit crop. Above we see a peach orchard at the Maryland State Experiment Station, showing the methods of spraying the trees to protect the fruit against insect enemies.

Right: A trap to catch insects for purposes of study. A light inside attracts the insects, which fly in under the hood. A fan prevents them from getting out again, but does not injure the specimens.



Lower pictures courtesy, N. Y. Department of Sanitation

Mosquitoes breed in damp, marshy places, especially where there is grass or reeds. Here we see a place of this kind being sprayed with larvicide from a tank carried on a truck. The spray kills the insect larvae.

THE MIGHTY INSECT

AN UNCONQUERED RIVAL OF MAN

MAN has won mastery over most of the other living creatures of the earth. He has tamed some of them; others he has driven before him as his civilization has spread over the surface of the globe. Yet the little insect has continued to defy him. It swarms in almost all the land areas of the world; it is found in lakes and ponds and rivers. The insect is mighty, indeed, in the very numbers with which it floods the earth.

It is almost impossible for us to realize how great these numbers are. There are, for example, rather more than 2,000,000,000 people in the world; we sometimes find far more than 2,000,000,000 insects in a single square mile. Suppose that we piled upon one side of a vast pair of scales all the insects of the earth. Suppose that we set on the opposite side of the scales all the land animals (including such bulky creatures as elephants and hippopotamuses). The insects would outweigh all the rest!

Insects are as remarkable for their variety as for their numbers. Already more than 600,000 different species or kinds of insects have been described; hundreds of new ones are discovered every year. They range in size from the giant Atlas-moth, with a wing-spread of a foot, to certain tiny wasps less than a hundredth of an inch long. In other respects besides size, they show the most astonishing differences. There are thin insects, fat insects, fierce insects, meek insects, flat insects, cylindrical insects that never move, insects that are as fleet as the wind.

Yet, however great the differences between the various species may be, all insects have certain things in common. For one thing, they all have six legs; for this reason they are sometimes called hexapods (from two Greek words meaning six legs).

The spider and the scorpion with their eight legs and the centipede with its thirty legs, or more, are *not* insects. They all—insects, spiders, scorpions and centipedes—belong to the general group of the arthropods (ar′-throh-pods) or creatures with jointed legs. Lobsters and crabs also belong to this group.

Brown Brothers

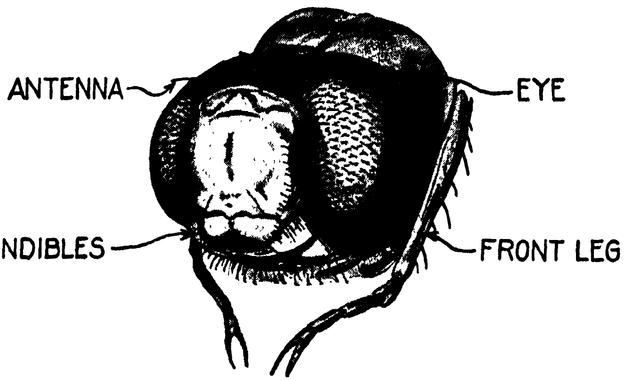
The housefly, one of the worst of insect pests.

Insects differ in a rather peculiar way from vertebrates—creatures with a backbone, such as horses, dogs and fishes. Vertebrates have a hard, fixed structure (the skeleton) in the inside of the body. Insects, on the other hand, have soft insides; they have a hard outside, made up of a horny substance called chitin.

The bodies of all adult insects are divided into three parts—the head, the thorax (middle part) and the abdomen (hind part). Both the thorax and the abdomen are divided into ringed sections called segments. (See the diagram on page 6065.)

Attached to the head are the insect's antennæ (an-ten′-ee) or feelers; these are organs of smell and touch and, occasionally, of hearing. The head also contains the eyes. There are two kinds of insect eyes—compound and simple. A compound eye is made up of a number of little eyes packed closely together; a simple eye is a single eye.

A great number of insects, including the fly, the bee, the moth, the butterfly, the dragon-fly and the mosquito, have two compound eyes, one on either side of the head. The small eyes that make up the compound eyes are six-sided and are called facets. The number of facets varies according to the species of insect; there may be as few as six or as many as 28,000. As it looks through these facets, the insect really sees as many images as there are facets. All of these images, however, are combined to make up a single general image, in much the same way as the dots of a photographic screen are combined to form a complete picture (see the illustration on page 1061).



This diagram of a dragon-fly's head shows the insect's huge eyes, tiny antennæ and formidable mandibles. You can see why the striking name of Odonata, or toothed ones, has been given to the order to which the dragon-fly belongs.

The simple eyes of the insect are called ocelli (oh-sell′-ee), which means little eyes in Latin. The ocelli, which are on the top of the insect's head, are not very useful organs of sight. They merely enable the insect to tell the difference between dark and light. Some insects have from one to three simple eyes besides two compound eyes. Other insects have only simple eyes; still others, like certain termites, are blind.

Different families of insects have different kinds of mouth parts. Many insects, like beetles and ants, have powerful biting jaws, with which they chew vigorously. The fly has a fleshy feeding part, called the proboscis (proh-boh′-siss), with which it laps up its food. Other insects, like plant-lice and chinch bugs, have mouth parts adapted to piercing the surface of plants and sucking the sap. The female mosquito has an assortment of drills with which it cuts our skin, as well as a delicate tube through which it sucks our blood.

The thorax, or middle part of the insect, contains the six legs, which are arranged in pairs. These legs, which are jointed, generally end in one or two claws, often with a pad beneath. In the case of certain insects, such as the housefly, the pad is fringed with hollow hairs, through which a sticky liquid oozes. This enables the insect to climb up a perpendicular (up-and-down) surface or even

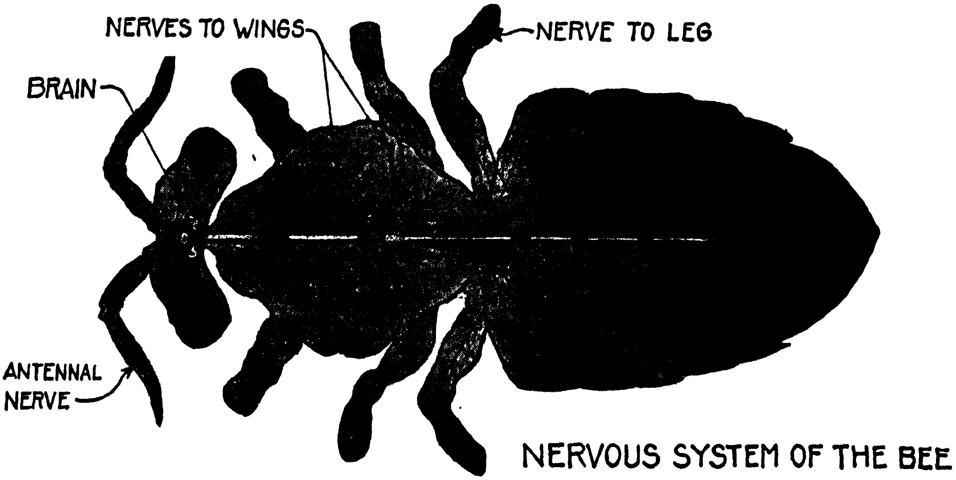
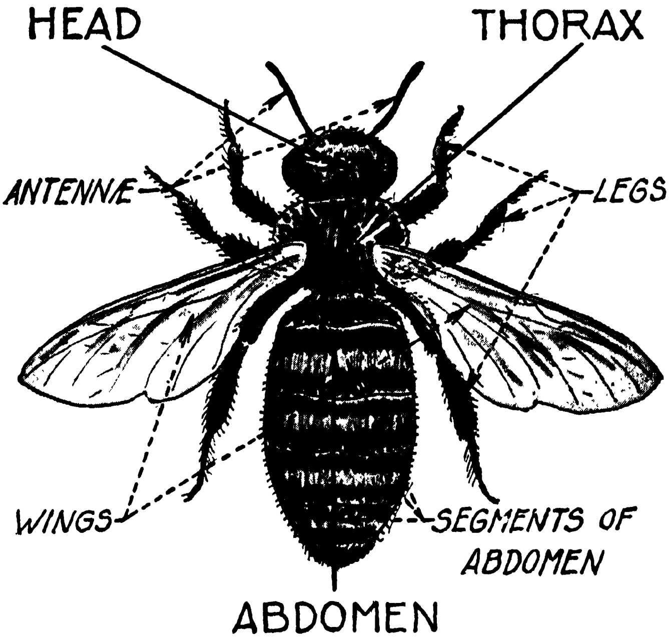


Diagram of the nervous system of the bee. The nerve cord, as you see, runs in a double line the length of the insect's body. The black circles appearing at intervals along the nerve cord are nerve centres known as ganglia. *Note how the network of nerves extends from the nerve cord to every part of the bee's body.*

to walk on the ceiling. The forelegs of the cricket and the katydid contain the organs of hearing.

The insect's wings, like the legs, are attached to the thorax. If you look carefully at them, you will see that they have a delicate network of "veins." These "veins" are really hollow rods, which greatly strengthen the wings. Some insects (like dragon-flies and moths) have four wings; others (flies, mosquitoes), only two; still others (fleas, bristletails), none at all.



This diagram, showing a bee as seen from above, will give you a good idea of the three parts into which all insects' bodies are divided—the head, the thorax and the abdomen. The legs and wings are always attached to the thorax.

The third, or hind part, of the insect—the abdomen—never contains either legs or wings. Here we find the digestive system and (in the female) the egg-laying system. The ears of certain kinds of grasshoppers are to be found in this part of the insect's body. They are set, curiously, in little folds of skin at the sides. Some insects (wasps, bees) have stings at the end of the abdomen. In other insects (grasshoppers, cicadas) the sting is replaced by the ovipositor (Latin for "egg-placer"). This is a tube-like organ, which, as the name indicates, is used in laying eggs.

The breathing apparatus of insects is very curious, for these little creatures breathe at many different places in the body. Air is drawn through a number of airholes arranged in pairs and extending down the insect's thorax and abdomen. These airholes, called spiracles (from Latin *spirare,* meaning to breathe), are connected inside the insect's body with tubes, known as tracheæ (tray′-kee-ee). A great number of branches take the air from these tubes, sometimes known as the tracheal tubes, to every part of the body, even to the wings and to the antennæ.

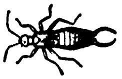
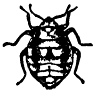
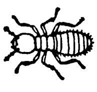
Most insects have a well-developed nervous system. The brain, which has two parts, is in the head. It is connected with the main nerve cord, which runs in a double line the length of the insect's body. At intervals along the cord there are nerve centres called ganglia, which look like swellings.

The great majority of insects come from eggs, laid by the female. (The aphid, or plant-louse, sometimes gives birth to living young.) A series of wonderful changes, known as metamorphosis (met-ah-mor′-foh-siss), takes place before the egg develops into the mature insect. Many insects (like the butterfly and the lace-wing) pass through four different stages of development—the egg, the larva, the pupa (pyoo′-pah) and the imago (ih-may′-go), representing the full-grown insect.

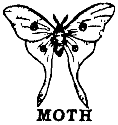
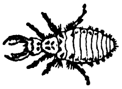
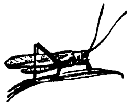
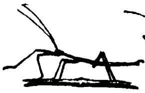
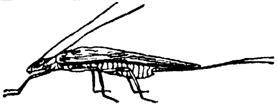
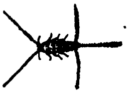
The egg hatches into the larva (the plural form is larvæ). There are different kinds of larvæ. That of the fly, for example, is a worm-like, smooth little creature, called a maggot. The larva of the beetle, known as the grub, is larger and thicker. The larva of the butterfly is the caterpillar. Maggots, grubs, caterpillars—all have terribly big appetites. They eat and eat and grow and grow until they grow too big for their skins. Then they shed the skin, appear in a new one, eat some more and shed that skin, and so on. Shedding the skin is called molting.

In the third stage of its development, the insect becomes a pupa (the pupa of the butterfly, as many boys and girls know, is sometimes referred to as a chrysalis, pro-

PRINCIPAL ORDERS OF INSECTS

Name of Order	Insects Belonging to Order	Remarks
ANOPLURA (ahn-oh-ploo′-rah) "UNARMED TAILS"	 LOUSE	Very small. Body flattened horizontally. No wings. No tail-like part. Sucking mouth parts. Parasite on various mammals, including man.
COLEOPTERA (col-ih-op′-ter-ah) "SHEATH WINGS"	 GROUND BEETLE	Vary greatly in size. Generally four wings; some species none. Thickened forewings form sheath, protecting hind wings. Chewing mouth parts.
CORRODENTIA (kor-oh-den′-shih-ah) "GNAWERS"	 BOOK-LOUSE	Small. Some species have four wings; some two; others none. Chewing mouth parts. Feed on paper; also on insects in museum collections.
DERMAPTERA (der-map′-ter-ah) "SKIN WINGS"	 EARWIG	Four wings. Few species none. Front wings short and leathery, like skin; hind wings large. Chewing mouth parts. Pincers at tip of abdomen.
DIPTERA (dip′-ter-ah) "TWO WINGS"	 MOSQUITO FLY GNAT	Small. Two wings; few species none. Lapping or piercing and sucking mouth parts. Hind wings replaced by knoblike growths, called halteres.
EPHEMERIDÆ (ef-eh-mer′-i-dee) "DAY CREATURES"	 MAY FLY	Small. Four wings; rarely two. Large hind wings. Mouth parts useless for feeding; hence adult insect lives day or so. Young live in water.
HEMIPTERA (heh-mip′-ter-ah) "HALF WINGS"	 GIANT WATER BUG CICADA  APHID SCALE INSECT BEDBUG	Vary greatly in size; include large and tiny insects. Four wings. In certain species, wings seem to be divided in halves, with part nearer to the body thick and rest of wing quite transparent. Hence the name Hemiptera or half wings. Mouth parts are adapted for piercing and sucking. Hemiptera are found on land and sea. The wings of some species (including cicadas and scale insects) have same thickness throughout. For this reason they are sometimes put in separate order, which is called Homoptera, or same wings.
HYMENOPTERA (hy-meh-nop′-ter-ah) "MEMBRANE WINGS"	 BEE WASP ANT	Vary in size. Four wings; sometimes none. Mouth parts adapted for chewing or for chewing and sucking. Often there is a sting at tip of abdomen.
ISOPTERA (ih-sop′-ter-ah) "EQUAL WINGS"	 TERMITE	Small; queen is large when laying eggs. Some have four wings, both pairs same size; others none. Chewing mouth parts. Live in big colonies.

PRINCIPAL ORDERS OF INSECTS

Name of Order	Insects Belonging to Order	Remarks
LEPIDOPTERA (lep-ih-dop′-ter-ah) “SCALE WINGS”	BUTTERFLY  MOTH	Often large. Four wings, covered with scales. Sucking mouth parts, coiled under the head when not in use. Body covered with hairs or scales.
MALLOPHAGA (mah-loff′-ah-gah) “WOOL-EATERS”	BIRD-LOUSE	Very small. Body flattened horizontally. No wings. Chewing mouth parts. Parasite, usually found on birds. Feeds on feathers, hair or scales.
NEUROPTERA (nyoo-rop′-ter-ah) “NERVE WINGS”	 ANT LION LACEWING	Fair-sized. Four wings, with many cross-veins, suggesting a network of nerves. Chewing mouth parts. Larvæ of Neuroptera prey on other insects.
ODONATA (oh-doh-nah′-tah) “TOOTHED ONES”	DRAGON-FLY DAMSEL FLY	Large. Four wings. Chewing mouth parts. Prey on other insects. The young are called dragons; they live in water and feed on water insects.
ORTHOPTERA (or-thop′-ter-ah) “STRAIGHT WINGS”	 GRASSHOPPER CRICKET COCKROACH LEAF-INSECT  WALKING-STICK MANTIS	Generally large. Four wings. Front wings thicker and narrower than hind ones; they are folded straight down insect's back when at rest. Chewing mouth parts. Many species have large hind legs and are wonderful jumpers. Most of the Orthoptera eat green plants; the mantis preys on other insects. Locusts, belonging to grasshopper family, are among most dangerous pests known to man. They fly in great swarms and leave land bare of vegetation.
PLECOPTERA (pleh-cop′-ter-ah) “FOLDED WINGS”	 STONE FLY	Rather small. Four wings. Hind pair are very large and are folded over when insect is at rest. Chewing mouth parts. The young live in water.
SIPHONAPTERA (sy-foh-nap′-ter-ah) “WINGLESS SUCKERS”	FLEA	Very small. Body flattened vertically. No wings. Sucking mouth parts. Hind legs fitted for jumping. Parasite on mammals, including man.
THYSANOPTERA (thy-sah-nop′-ter-ah) “TASSEL WINGS”	THRIPS	Very small. Four wings; sometimes none. Wings are fringed with long hairs, suggesting tassels. Sucking mouth parts. Usually found in flowers.
THYSANURA (thy-sah-noo′-rah) “TASSEL TAILS”	 SILVERFISH	Usually small and delicate. No wings. Very long antennæ and tail. Tail is fringed with short bristles. Chewing mouth parts. Found in houses.
TRICHOPTERA (trih-cop′-ter-ah) “HAIR WINGS”	CADDIS FLY	Related to moths and butterflies. Small. Four wings, covered with hairs. Chewing mouth parts. Young, called caddis worms, live in water.

nounced criss′-ah-liss). Before they reach this stage, the larvæ of many species spin for themselves a silken covering—the cocoon, which is often attached to the bark of a tree or to a branch or leaf.

THE PUPAL STAGE, WHEN THE INSECT UNDERGOES GREAT CHANGES

The word pupa comes from a Latin word meaning doll. A pupa is, indeed, a kind of insect doll; it is hardly more lively than the flaxen-haired and prettily dressed toys that delight little girls. The pupal stage, you see, is a time of rest; the insect takes no food and generally remains quite still. In this stage the insect undergoes the greatest changes of all. When it bursts from the old pupal skin at last, it is a full-grown adult. It is the very image of its parents and for that reason it is called the imago (from a Latin word meaning image).

In the case of certain insects, like grasshoppers and earwigs, there is no pupal stage. The egg hatches into a form which is called the nymph. The nymph resembles its parents; the nymphs of winged species, however, have no wings. While the little insect is growing, it molts several times. After the last molt it becomes a fully grown adult insect.

SEVENTEEN YEARS FROM THE INSECT EGG TO THE ADULT FORM!

Some insects, like the housefly, develop from the egg to the adult form in a week or so; others like the grasshopper, have only one generation a year. It takes the insect known as the periodical cicada longest of all to develop. The young periodical cicada lives underground for seventeen long years (thirteen years in certain forms) before it becomes the adult imago.

Insects can reproduce their kind at an almost unbelievable rate. A female fly, for example, can lay as many as 500 eggs in the course of a season. Each egg develops into an adult insect in about a week; each new female insect can then lay 500 eggs of its own. If all the eggs hatched and if all the newly hatched flies survived, the original female fly would have some 200,000,000,000,000,000,000 descendants at the end of a single season!

If flies continued to breed at this rate, they would soon crowd us right off the earth. Fortunately, however, these insects have any number of mortal enemies—man, lizards, frogs, spiders and dragon-flies, among others —that kill them off at a great rate. Fortunately, too, only a very small number of flies survive the coming of cold weather.

As a matter of fact, most adult insects die in the winter. They leave their eggs or their larvæ in sheltered places—in the ground or in rotten logs or beneath the bark of trees. Occasionally the adult female insect survives the winter, remaining in a state resembling sleep until the warm weather comes. Then she turns again to the task of laying eggs. Certain insects (like cockroaches and bedbugs) that make their homes in man's dwellings are not much affected by conditions out-of-doors.

INSECTS THAT ARE INTERESTED ONLY IN THEIR OWN WELFARE

The insect, generally speaking, is a self-seeking creature, interested only in its own welfare. Insects often appear together in swarms; yet each individual in the swarm takes care pretty much of its own interests. Some insects, like the fierce mantis, not only keep aloof from members of their own species, but even prey on them.

Not all insects are so self-seeking, however. Bees, wasps, termites and ants live in colonies; all that the individual insects do is for the good of the colony. The queen attends faithfully to the business of laying eggs. There are workers that collect food and care for the young; there are soldiers that keep off enemies. We shall tell you more about these wonderful insect colonies in other chapters of The Book of Knowledge.

Insects are well provided by nature with weapons of attack and defense. Some insects carry the fight to the foe with powerful pincers, sharp beaks and deadly stings. Other insects find effective ways of defending themselves. The outer skin of beetles, for example, is so tough that it is like a coat of armor and can sometimes defy the sharp beaks of birds.

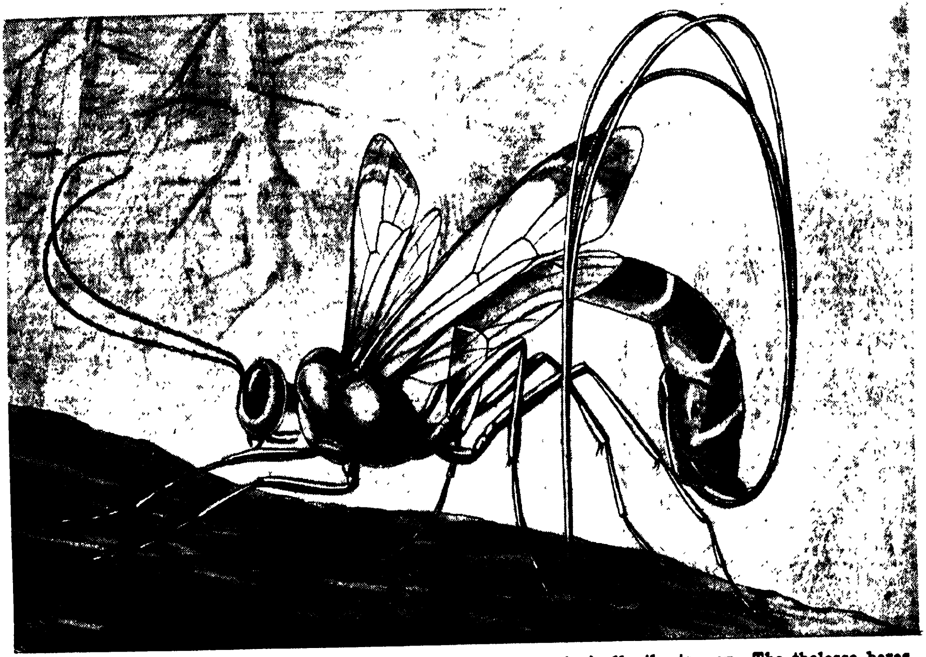
THE LITTLE BOMBARDIER BEETLE, AN INSECT POISON-GAS EXPERT

Some insects foil their enemies by means of gas attacks—for this sort of warfare was common in the insect world long before man thought of using it in battle. The most renowned of the insect poison gas experts is the bombardier beetle. When pursued by a larger insect, it fires at the foe from two glands at the end of its body. There is a sudden "pop" like the report of a tiny popgun, and the pursuer finds its way barred by a cloud of ill-smelling vapor.

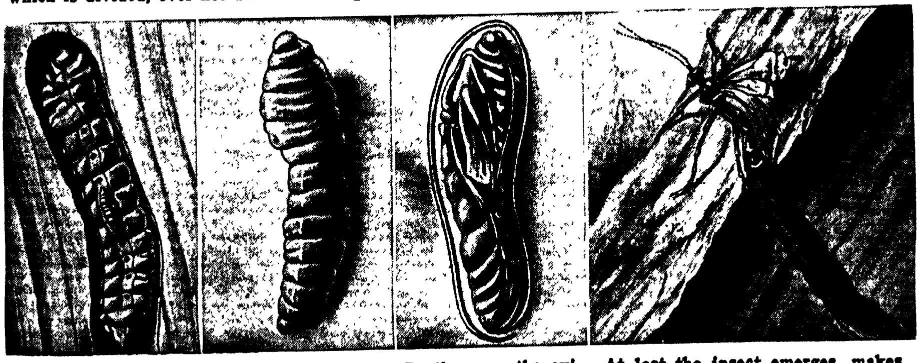
Some harmless insects manage to frighten off their foes by resembling certain fierce insects that these foes leave severely alone. The timid earwig, for example, has formid-

THE FRIENDLY ICHNEUMON FLY

One of the strangest of the ichneumon flies is the thalessa. On the right is a male and on the left a female. Both insects are flying, and it will be noticed that the female has an enormously long ovipositor for depositing her eggs, which trails out behind her as she travels through the air.



This insect is a parasite on the larvæ of wood-boring insects, principally the tremex. The thalessa bores into wood and lays an egg near the place where the tremex has already laid her egg. To see the female thalessa laying her egg is an interesting sight to an entomologist. The thalessa curves her ovipositor, which is divided, over her back and brings it forward to bore the hole and lay the egg.



When the ichneumon larva hatches out it attaches itself to the tremex larva and feeds greedily on it.

This shows a magnified view of the thalessa larva when it is about ready to change into a pupa.

In the pupa the ovipositor is curled round the body ready to be unfolded when the right moment arrives.

At last the insect emerges, makes its way out of the timber, opens its wings and flies off in the way shown in the first picture, to repeat the strange life-story.

able-looking pincers at the tip of its abdomen; these pincers frighten off certain enemies. Certain species of flies manage to look suprisingly like honey-bees, which, as you know, can sting like fury.

SOME INSECTS THAT MANAGE TO LOOK JUST LIKE THEIR SURROUNDINGS

Other insects are past masters at camouflage—the art of looking as much as possible like one's surroundings. The walking-stick can hardly be told from the twig on which it rests; the leaf-insect imitates a leaf just as successfully. Even the gorgeously colored butterfly often blends perfectly into its surroundings when it folds its wings.

Such, then, is His Majesty, the insect. We would find him a fascinating little creature if he lived on another planet and never came into contact with us. We find him doubly interesting because he is our neighbor and because he is capable of doing great harm and great good to man.

The harm that insects do is more apparent in most cases than the good. The truth of the matter is that most of us find these little creatures annoying and often tormenting. Mosquitoes puncture our skins with their beaks and suck our blood. Swarms of black flies and gnats pursue us relentlessly. Bees, wasps and hornets use their stings on us when they suspect our intentions—and they are suspicious creatures. Flies and cockroaches crawl over our food. Fleas settle cozily in our clothing; bedbugs love to make their homes in our beds.

Of course the extent to which one is troubled by insects depends on time and place and other factors. We all know that most insects are inactive in the late fall, winter and early spring. Even at the time when they thrive, they are generally not nearly so troublesome in the city as in the country. Again, people who keep themselves and their houses and their belongings clean are less apt to be troubled by such insects as lice, fleas, bedbugs and cockroaches than people who are careless.

VERY FEW PEOPLE MANAGE TO ESCAPE THE ATTENTIONS OF INSECTS

Yet, in spite of all, hardly any one of us can escape the unwelcome attentions of insects. When we think of the weapons with which nature has provided ants and bees and wasps and mosquitoes, we should be thankful that they are not larger or that we are not smaller. As it is, insect bites and stings in themselves produce no serious after-effects in most cases.

The real harm that insects do to mankind is brought about in more or less indirect ways. For one thing, they help to spread some of the most terrible diseases known to man. Certain species of mosquitoes carry the germs of malaria and yellow fever. Lice spread typhus. Fleas are carriers of the dread bubonic plague.

The seemingly innocent little housefly is one of the most dangerous pests of all. Bred in filth, it carries many dangerous germs upon its hairy legs and it spreads these germs upon the sugar, bread, milk and other human dishes on which it loves to feed. Houseflies have brought about epidemics of typhoid fever, diphtheria and yellow fever; in some parts of the world they spread anthrax and cholera.

THE DAMAGE THAT HARMFUL INSECTS DO TO PLANTS USEFUL TO MAN

Insects do fearful damage to the plants that man uses as food for himself and his animals; they do great harm, also, to plants such as cotton and flax and hemp, that are useful in industry. The growing crops of the field, the fruits of the orchard and the trees that we use for timber are attacked by greedy armies of caterpillars, plant-lice, boll-weevils, corn-borers, Japanese beetles, tomato fruitworms, scale insects and codling-moths. It is estimated that insects consume 10 per cent of all the plants that are useful to man.

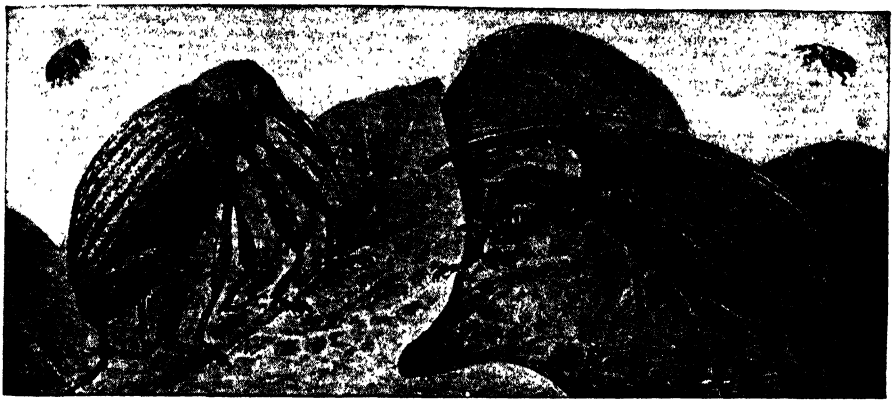
Insects often harm crops by spreading plant diseases, caused by various kinds of bacteria which are carried in the insects' bodies. Some insects make holes in the plant through which bacteria from various sources enter. Others carry harmful bacteria in their mouth parts and infect the plant when they pierce the outer surface.

TERMITES, LEAD-CABLE BORERS AND CLOTHES-MOTHS ARE ALL DESTRUCTIVE

This is by no means the whole story of the destruction brought about by insects. Termites or white ants attack the wood of telegraph poles and houses and furniture. A beetle called the lead-cable borer makes holes in the lead coverings of telephone cables. We are all familiar, alas, with the unwelcome activities of clothes-moths.

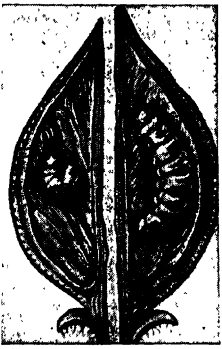
Man must wage constant warfare against the harmful insects that we have named. Chemicals, like arsenic, sulphur, rotenone and nicotine, are used as insecticides (insect-killers); they are generally used in combination with other substances. Oil is generally an effective insecticide, although certain insects are less affected by oil

THE COTTON BOLL-WEEVIL—A REAL PEST

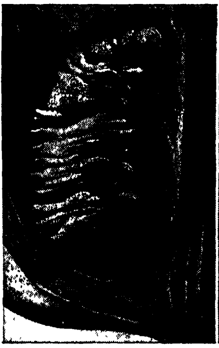


In spring a little brownish beetle appears on the cotton plants in America, having just awakened from its winter sleep, and begins to feed on the leaves of the plant. Here we see it in two positions, natural size, and greatly magnified. It is one of the worst enemies of man, and is injuring the cotton industry.

When the buds form, it bores a hole and lays an oval, pearly white egg inside, visiting several buds each day.



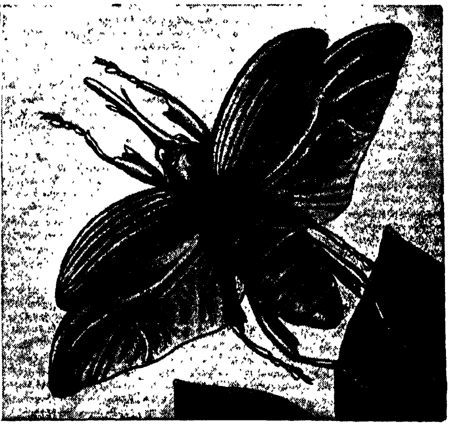
In three days the egg hatches out into a tiny white larva, or grub, with a brown head, and this feeds on the bud.



The grub, as it grows, changes its skin three times, and its castings form a case inside which it changes to a pupa.

Here is the pupa, and in four or five days the case splits open and the adult weevil comes out and repeats the story.

Each female lays several hundred eggs, and when the bolls, or seed-cases, containing the cotton are formed, eggs are laid in these, the larvæ feeding on the cotton and ruining the boll. In twenty weeks the offspring of a pair of weevils reaches 12,755,100.



With the first frosts of autumn many adult weevils die, but others fly off to hibernate in hedges, woods, cornstacks, farm buildings, under the grass, or in empty cotton bolls. In spring they wake up, come out, and begin again the story.

than others. In fact the petroleum fly actually breeds in pools of waste petroleum.

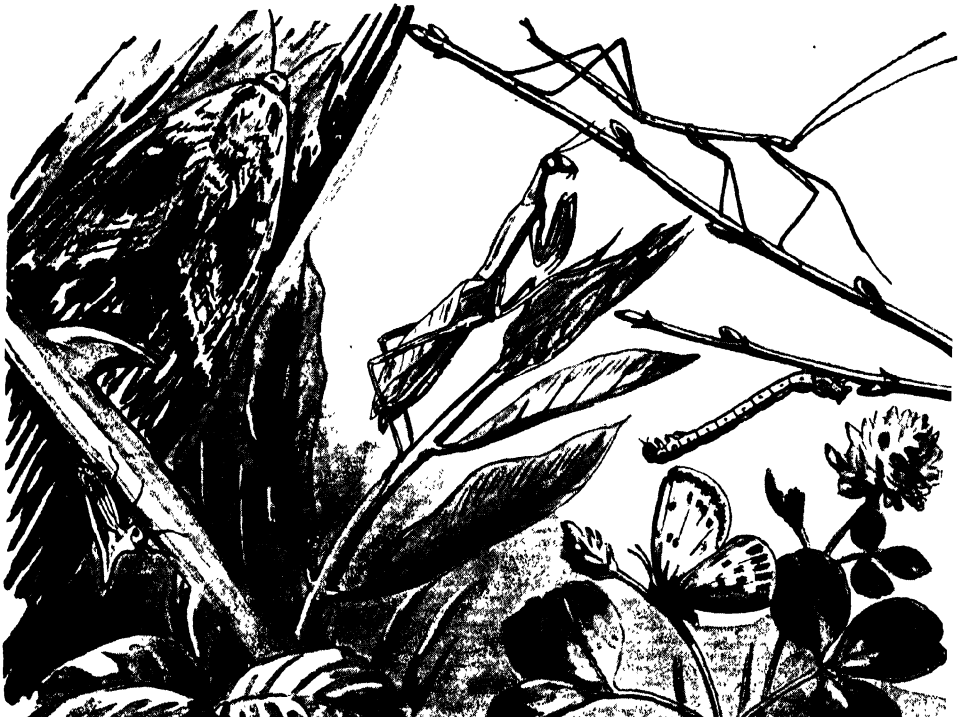
Certain insecticides are sprayed on trees; others, in the form of a powder, are dusted on the fields from carts or from low-flying airplanes. Sometimes chemicals are applied in the form of a gas in grain elevators, factories, houses, hospitals, ships and railway cars—we call this process fumigation. Oil is sprayed on the breeding-places of mosquitoes—marshes and stagnant pools.

Sometimes, instead of trying to kill harmful insects, we do our best to keep them away. We use screens for our houses and netting for our beds. Netting is also used by men who must spend considerable time out-of-doors in places where mosquitoes, black flies and other pests are very numerous. Sometimes we use chemicals called repellants to keep insects away. Thus, wood is treated chemically to preserve it against termites. The substance called citronella is smeared on one's face and hands to discourage mosquitoes and is usually effective.

Another method of combatting the activities of insect pests is to bring in other insects in order to prey upon them. The mulberry scale, a pest that attacked the mulberry trees of Italy, was brought under control by a tiny wasp-like parasite brought from America. (A parasite is a creature that makes its home on the body of a living thing.) Australian ladybirds were introduced into California in order to devour the scales and mealy bugs that threatened the fruit trees of that state.

To prevent harmful insects from being brought to our shores from foreign lands, ships and planes are thoroughly inspected upon their arrival at our ports. Inspection stations are also to be found along our frontiers. Sometimes they are set up inside a country in order to prevent one section of it from being infested by an insect that has already established itself in another section.

Yes, we must be constantly on our guard lest our insect enemies should overwhelm us. Yet, if we should succeed by some miracle ir

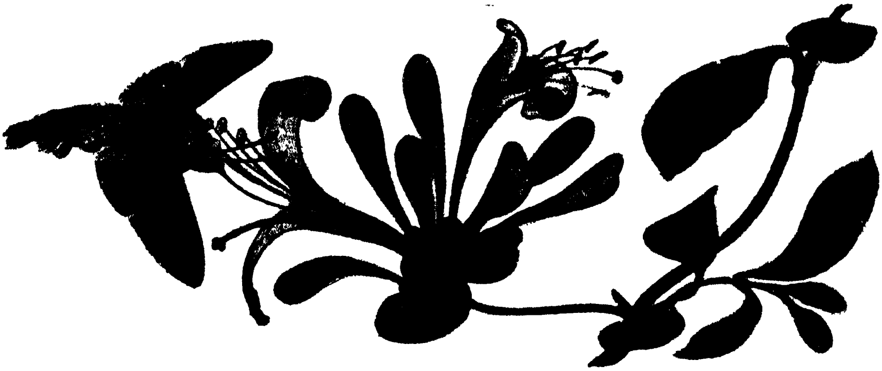


Camouflage in the insect world. The sphinx moth, in the upper left-hand corner, and the tree hopper, belo him, blend into the background. The praying mantis, in the centre, and the walking-stick, above him, loo like the stems on which they rest. The inchworm, swaying from a stem, is not very noticeable. Even the show butterfly, in the lower right-hand corner, fades into the background of leaves and flowers when at res

FLOWERS AND THEIR VISITORS

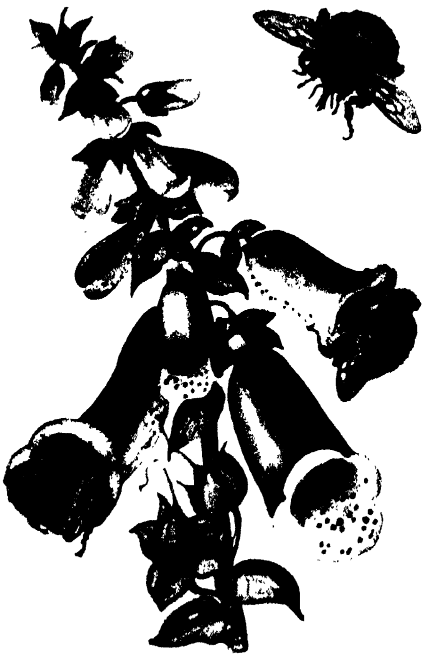
There is a wonderful partnership between plants and insects, the flowers supplying the insects with food, and the insects carrying the pollen from plant to plant to fertilize the ovaries and produce seeds. In these pictures some examples of how plants and insects work together are given.

A honeysuckle blossom with a humming-bird hawk-moth approaching it, attracted by the scent. The tubes of the flower are half full of nectar, and to reach this the moth puts out its long tongue.

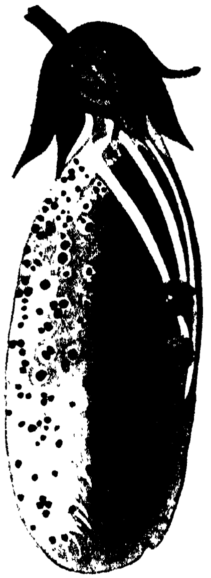


A young honeysuckle flower with the stamens erect and the pistils depressed. One corolla, or tube, is shown in section, and we see the moth sucking nectar with its long tongue, while the head and wings are being dusted with pollen from the anthers. As the moth flutters it shakes the pollen on to its body.

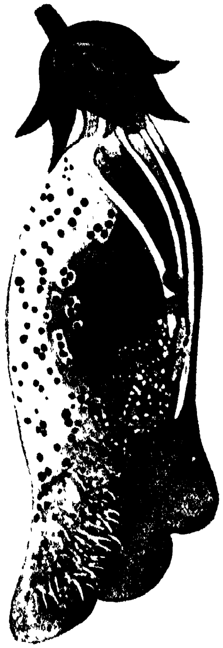
We have here an older flower with the pistils erect and the stamens depressed. As the moth sips the nectar the pollen from another plant is dusted on to the pistil, where it fertilizes the ovules and produces seeds. As the flower matures the corolla, or tube, curls back from the pistils and stamens.



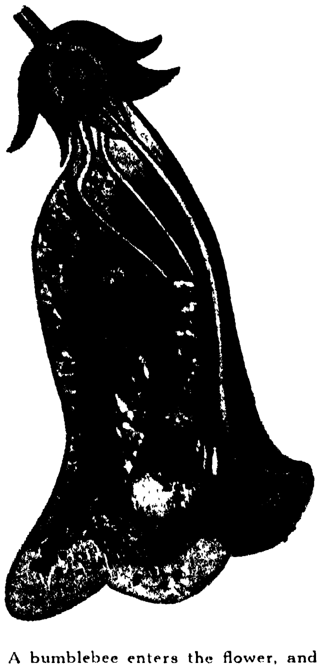
This spike of foxglove shows the buds and flowers in various stages of development, with bumblebees visiting them, and also seed capsules



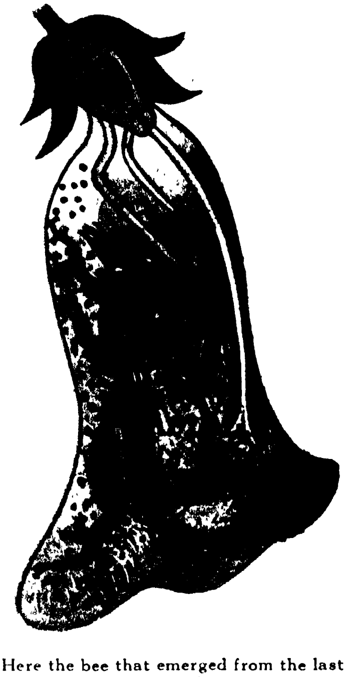
A section showing first position of long and short stamens.



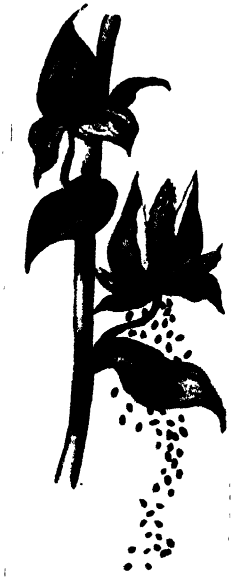
The longer stamens of an opened flower shedding their pollen.



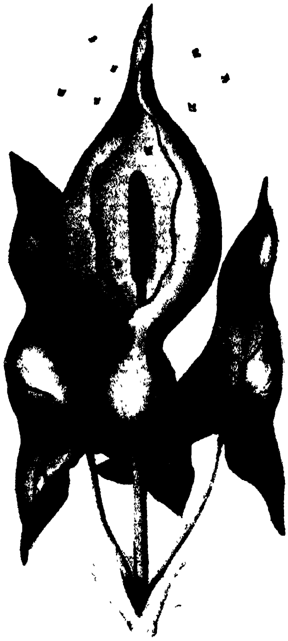
A bumblebee enters the flower, and the pollen is scattered on it as it gathers nectar round the ovary. The stigma, or part that sooner or later receives the pollen for fertilization, is still closed.



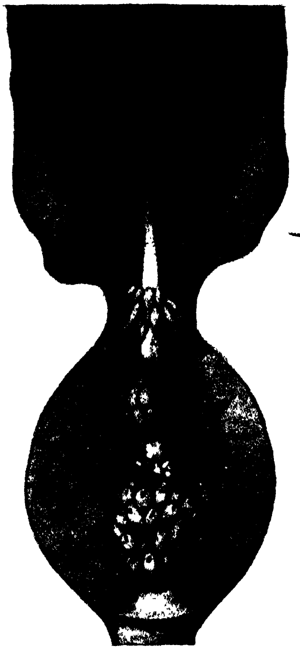
Here the bee that emerged from the last flower is entering another flower, where the stigma is open to receive it, and as the bee pushes past, the pollen is rubbed off on the stigma. The pollen-producing anthers are withered.



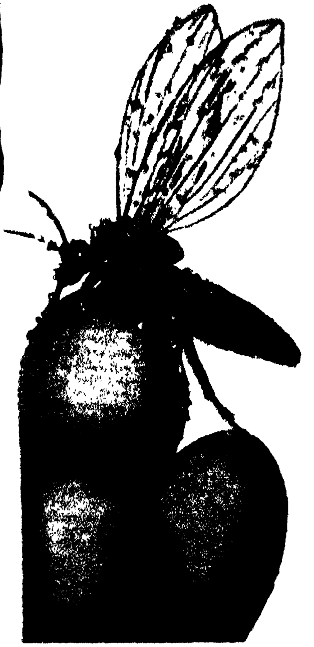
The pollen working down, fertilizes the ovules, which develop into seeds, and here the capsule is bursting and the seeds are pouring out.



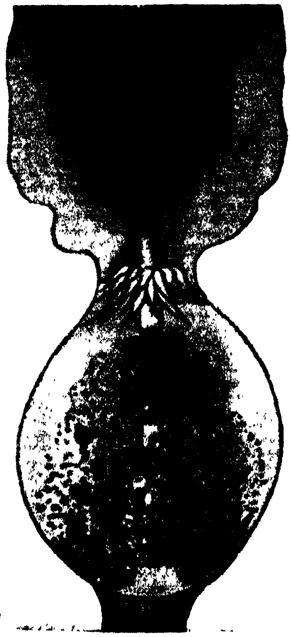
The wild arum, or cuckoo-pint, with its spathe and spadix, or fleshy spike. It is a cousin of our jack-in-the-pulpit. Midges creep down the spadix, attracted by the disagreeable smell.



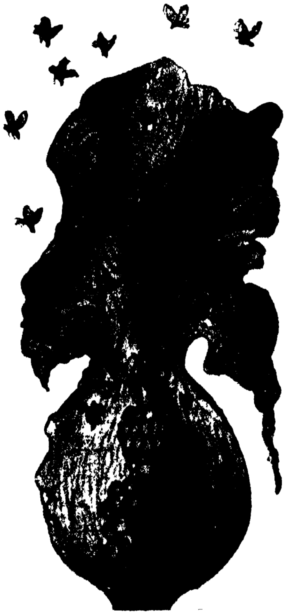
This spathe is cut open to show the midges covered with pollen from an older plant, entrapped by a palisade of spikes. As the insects fly about, the pollen is rubbed off on to the stigmas at the base of the spadix.



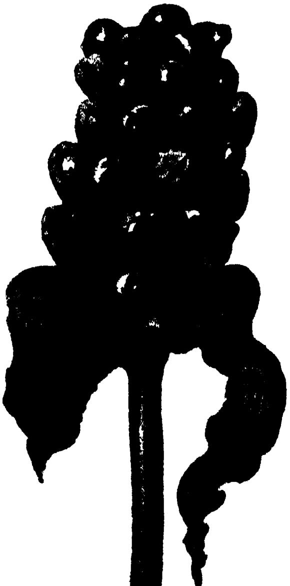
This magnified view shows a midge pollinating the stigma, after which nectar is given out by the stigma. One tiny pollen-grain is sufficient to fertilize the ovary below the stigma.



The ovules, having been fertilized, are growing larger. The purple anthers have now burst and are shedding their golden pollen on the midges.

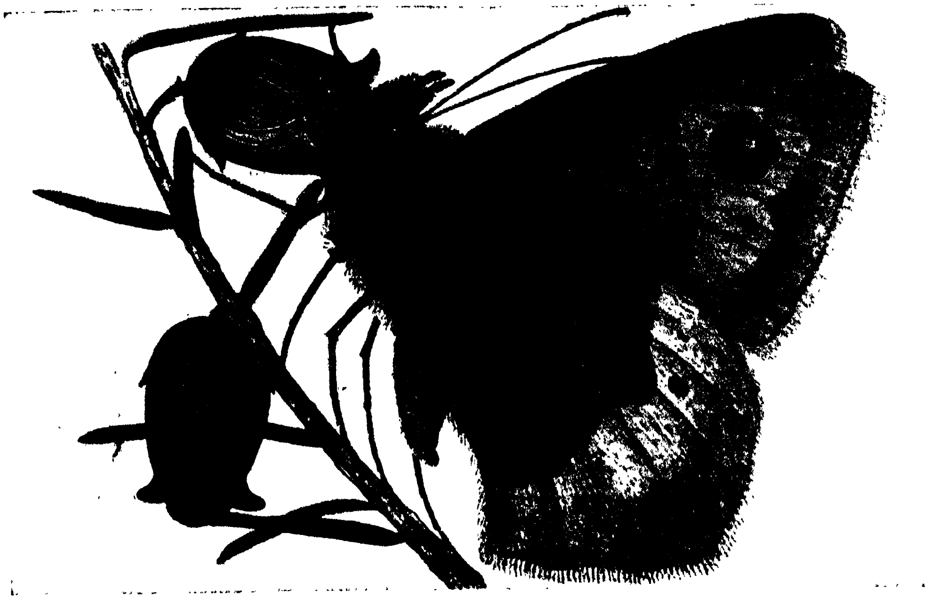


The midges being loaded with pollen, the palisade droops, allowing the insects to escape. They go off and visit another plant, repeating the process.

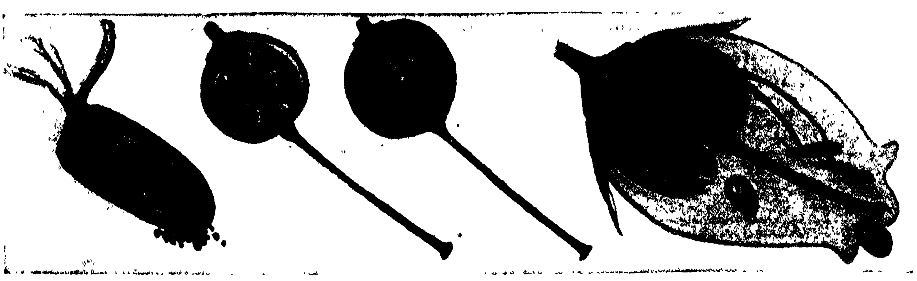


The ovules, being fertilized, develop into the familiar red berries known to country children as lords and ladies. They are the fruits containing the seeds.

This picture shows the beautiful bell-shaped flowers of the heath, and two meadow brown butterflies flying round them. The butterfly on the left is a female, and that on the right a male.



Here one of the flowers is cut open and greatly enlarged so that we may see what goes on when the butterfly pushes its tongue down to the nectar. It already has pollen on it from another flower, and this is dusted off on to the ripe stigma, fertilizing the ovules, while the stamens are disturbed, and the pollen pours out from little holes on to the butterfly's head.



On the left is one of the anthers on the end of the stamen, magnified, and the pollen is pouring out. In the centre is a section of the pistil with the fruits developing, and on the right we see the fruit, consisting of a capsule with four cells.

Here we see a flower cut open to show the capsule after it has been split, dispersing the seeds to continue the race of heaths.

stamping out *all* insects, the result would be quite disastrous. Without insects, for example, we would be deprived of many of our finest fruits and vegetables and flowers —all those which must be fertilized by such insects as wasps and bees and butterflies. (See Index under Flowers—fertilization.) There would be no oranges, lemons, grapefruit, apples, pears, melons, strawberries, cranberries, peas, figs and dates; many of our loveliest flowers would no longer grace our gardens or the countryside.

The fertilizing activities of insects are difficult to measure in terms of dollars and cents, of course. We can, however, set a money value on certain things that insects produce for us. The silkworm (which is really a caterpillar that grows into a moth) provides us with glossy silk. Bees make honey and a substance called beeswax. Certain scale insects give us shellac. Tannin, useful in tanning and medicine, is produced by the activities of small wasp-like insects called gallflies. These little insects lay their eggs in the delicate tissues of twigs or leaves. In so doing they irritate the tissues so much that swellings form on the outside of the twigs or leaves. The swellings, which are shaped like little nuts, are called nutgalls; they yield considerable quantities of tannin — tannin of unusually fine quality.

Insects provide food for the fresh-water fish that we eat and for the birds that delight us with their song. In certain lands insects even form part of the human diet. Some Mexicans consider the maguey worm, a plump sort of caterpillar, as a delicacy; roasted crickets delight many natives of Jamaica.

Some insects are useful because they prey on insects that are harmful to man. The dragon-fly devours the mosquitoes that spread yellow fever and malaria; the lady-

Some insects are at home on land; others in the water. In this picture we see the wasp (upper right) about to enter its nest. Ants are seeking food for their colony. The ground bettle is on the lookout for insect victims. The damsel fly hovers over the pond; the diving water beetle has just plunged beneath the surface.

bird feasts on the scale insect that attacks our fruit trees; the mantis preys on destructive beetles. As we have seen, we sometimes introduce into a district the insect enemies of the pests that attack our crops.

It is clear that from our point of view there are good insects and bad insects. We must realize, of course, that insects that are helpful to man are not necessarily better, strictly speaking, than the insects that are harmful to man's interests. The praying mantis, for example, is a bloodthirsty murderer, constantly on the lookout for new insect victims; in fact, he thinks nothing of devouring a brother mantis. Why, a female mantis will sometimes kill and eat her own mate! On the other hand, the little aphis or plant-louse never molests any other insect or any living creature, for that matter. He lives a peaceful life, sucking away at the juice of plants.

Yet it so happens that the praying mantis is helpful to man because some of his insect victims destroy our crops. On the other hand, the aphis feeds on many plants that are useful to man. Therefore we must consider the meek little aphis our enemy and the cruel mantis our friend.

Are we then to divide all insects into two classes—the enemies of man and his friends? That would not give a true picture of the situation. The fact of the matter is that most species of insects are neither helpful nor harmful to man, except perhaps in the most indirect sort of way. They do not molest us; they do not attack our domestic animals; they do not rob us of the plants that we use for food or clothing.

Of course, as man's civilization spreads over the world, some of these "neutral" insects may become harmful, just as other "neutral" insects have become harmful in the past. If we destroy the grass and the shrubs and the trees on which they feed, they are likely to seek their food in our gardens, our orchards or our homes. If we kill off the wild life that they now attack, they may turn their attention to our domestic animals or even to ourselves.

In the Animal Life chapters that follow we shall tell you more about our neighbors, the insects. We shall tell you the fascinating story of bees, wasps, ants, mosquitoes, flies, butterflies and other members of the mighty insect family.

THE NEXT STORY OF ANIMAL LIFE IS ON PAGE 6221.

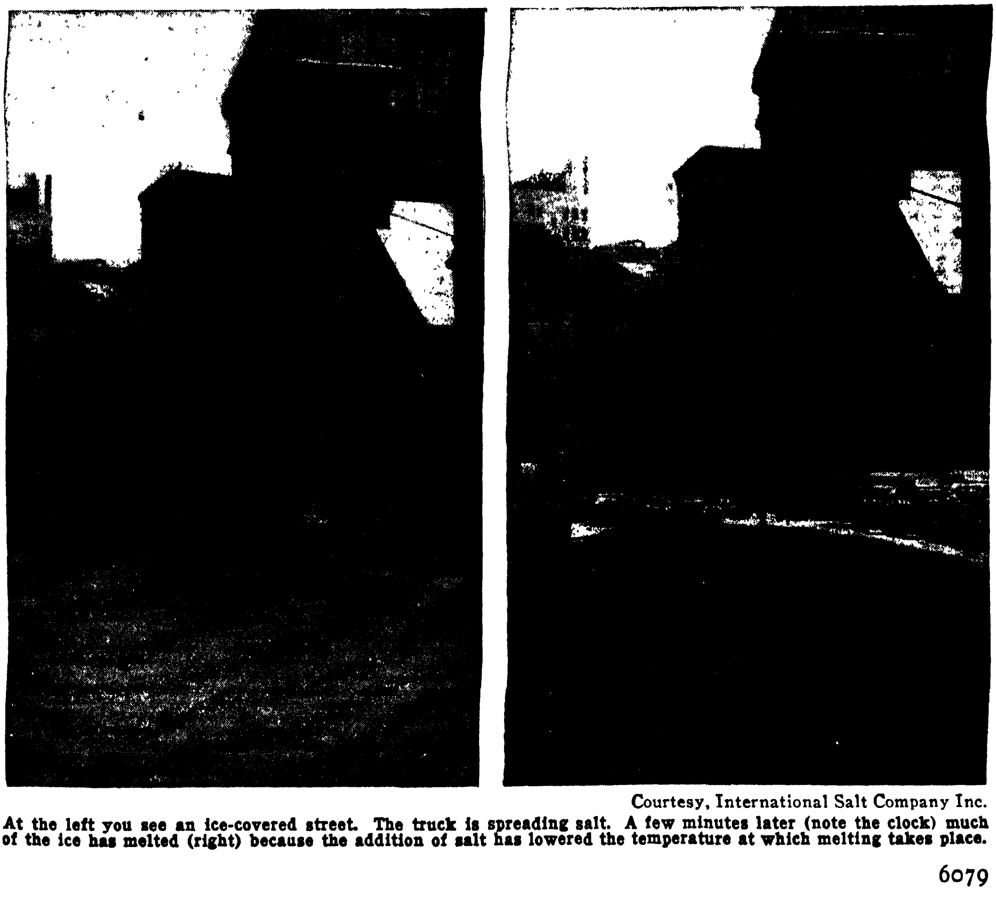
Why the housefly is a deadly menace. The flies shown in this picture have been feeding on refuse heaps and the contents of open garbage cans. Their hairy legs have become covered with germ-laden particles of filth. They then enter a human dwelling and, lighting on the food so temptingly displayed for them, they spread disease germs. Flies have brought about terrible epidemics of typhoid fever, diphtheria and yellow fever.

SCIENCE

IONS *and* HOW THEY BEHAVE

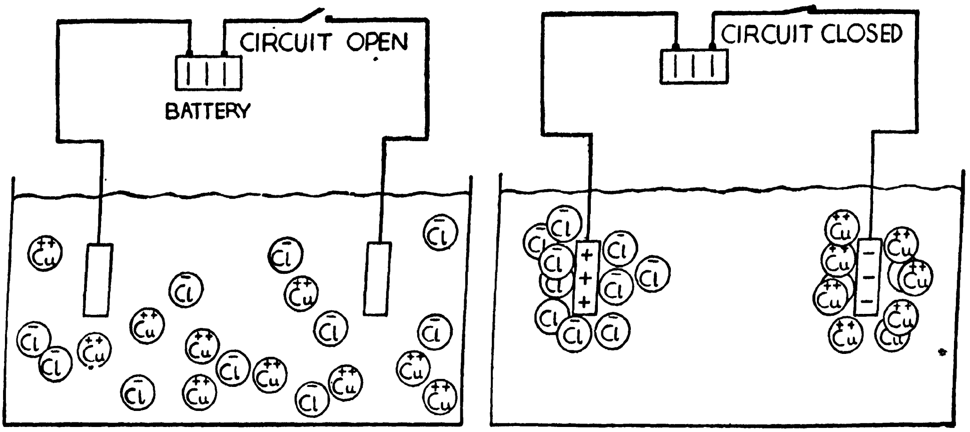
IN the article on Chemical Behavior we told you what a solution is and why the chemist uses solutions so much. Let us review briefly. When we put two dry substances together, we often have a good deal of difficulty getting them thoroughly mixed; but if we can dissolve each of them in water and then pour the solutions together, they mix perfectly and the chemical reaction between them takes place very easily and quickly. Now let us see why this is so. When we dissolve a substance in water, we do not merely make a good mixture of it and the water. Other interesting things happen also, and the solution does not behave like water any more. Let us see what does happen.

First of all, a solution is always a little slower than water to act. It is a little sluggish, we say. You know, of course, that pure water will boil at a temperature of 212 degrees Fahrenheit—that is, if you live near the coast or are practically at sea level. You know also that water will freeze when you cool it to just below 32 degrees Fahrenheit. But if you dissolve some sugar in water, you must bring it to a temperature higher than 212 before it will boil; and it will not freeze until you cool it to well below 32 degrees Fahrenheit. If you live in a town where there is much ice and snow in winter, you



Courtesy, International Salt Company Inc.

At the left you see an ice-covered street. The truck is spreading salt. A few minutes later (note the clock) much of the ice has melted (right) because the addition of salt has lowered the temperature at which melting takes place.



Copper chloride molecules break up in water, but not into three perfect atoms. Each of two chlorine atoms captures an electron from a copper atom, becoming a negative ion and leaving the copper as an ion with a double positive charge. When an electric current flows, the positive ions travel to the minus pole and the negative ions to the plus pole.

have probably seen that some people put handfuls of rock-salt crystals on their porch steps and sidewalks. The salt and the snow form a solution which does not freeze as easily as water; thus the steps and the walks do not become icy, even in very cold weather.

We do the same kind of thing with our cars in winter. By mixing alcohol and glycerin with the water in the radiator we lower the freezing point and prevent the liquid from freezing even though the car stands out in very cold weather. Many of you know that we always put salt in the ice of an ice-cream freezer. Why? By adding salt we lower the temperature (below 32 degrees F.) at which the melting takes place. Melting at this lower temperature requires more heat. This heat is absorbed from the ice cream, making it freeze.

When chemists tried to look into these things a little more carefully, and tried to measure how much the freezing and boiling points were changed, the answers looked very complicated at first. Naturally, the more salt or sugar you put in water, the greater the change. But it takes nearly four ounces of sugar, dissolved in a quart of water, to produce the same change as only one ounce of glycerin. Why? Experiments made by the French physicist Raoult showed us the answer, which is very simple.

We know that the smallest particles, the molecules, of every kind of substance are made up of still smaller particles, called atoms. Some molecules are very simple, and have only a few atoms in them. Others are very big and complicated, with many atoms. The chemist writes down in his formulas the number of atoms in each molecule. Raoult showed us that the only thing that counts is the number of molecules in the solution.

If you dissolve the same number of sugar molecules in water as of glycerin, then you get the same change. But an ordinary sugar molecule is written $C_{12}H_{22}O_{11}$ and it weighs 342 units (12x12 plus 22x1 plus 11x16). You get the figure by multiplying the number of atoms by the atomic weight of each atom. The formula for a molecule of glycerin is $C_3H_8O_3$ and it weighs only 92 units. There, you see, is our ratio of nearly 4 to 1. An ounce of sugar will contain only one-fourth the number of molecules that an ounce of glycerin contains. The action of a solution depends, too, on what liquid we use as a *solvent,* that is, to dissolve our substance in. Benzene, alcohol or gasoline will differ from water.

However, water is the solvent we use most. Suppose we dissolve ordinary salt, $NaCl$, in water. $NaCl$ weighs 58½ units, or nearly six times less than a molecule of sugar. We might expect that an ounce of salt, dissolved in a quart of water, would give us a change in boiling and freezing points of the same amount as when we dissolved six ounces of sugar. But that, we find, is not so. The change with one ounce of salt is nearly twice what we expected. If we take an ounce of sodium sulfate, Na_2SO_4, which weighs 142 units, we do not get the same change as with three ounces of sugar: we get nearly three times as much. In other words, the salt behaves as if each molecule split into two separate particles; and the sodium sulfate behaves as if each molecule split into three parts.

We find this is generally true when we dissolve in water any of the compounds which we usually call "salts"; they give strong indications of splitting into two or more parts. More than that, a solution of any such salt in water lets an electric current go through; but a sugar solution or a glycerin solution does not. We believe now that in "salt" solutions in water there are particles charged with electricity. We call these particles ions. (The word rimes with lions.)

HOW IONS ARE FORMED WHEN WE PUT COMMON TABLE SALT IN WATER

Svante Arrhenius was the first to think this through. We have changed his original ideas a little, but not very much. What we now think happens is this. When we dissolve such a salt in water, the molecules of the salt split into ions, sometimes single atoms, sometimes combinations of atoms, but not complete atoms perfectly balanced electrically; some of them carry positive charges, and others carry negative charges. Together, of course, the parts have as many positive as negative charges. Ordinary salt, sodium chloride, $NaCl$, splits into Na^+ and Cl^-. In other words, the sodium atom has lent one of its electrons to the chlorine, and it becomes a sodium *ion* with one positive charge. The chlorine atom borrows the extra electron and becomes a chlorine *ion* with one negative charge. Sodium nitrate splits into the positive Na^+ ion, and the negative $(NO_3)^-$ ion.

THE NUMBER OF ELECTRONS AN ATOM CAN LEND OR BORROW TELLS WHAT ITS VALENCE IS

In the article on Chemical Behavior you have read about what the chemist calls "valence." Valence results from the fact that some atoms have "odd" electrons in their outer shell which they readily lend, while other atoms readily borrow these "odd" electrons to complete their outer shell. Magnesium and copper have two electrons they are eager to lend. Aluminum has three. Magnesium chloride has the formula $MgCl_2$. When we dissolve it in water it splits into three ions—one magnesium ion, which carries two positive charges, and two chlorine ions that carry one negative charge each. We write them Mg^{++} and $2Cl^-$.

When we dissolve sodium sulfate, Na_2SO_4, in water we have the opposite: two sodium ions, $2Na^+$, with a single positive charge each, and one sulfate ion, with two negative charges $(SO_4)^{=}$. We call such complex ions, which we often find in acids, radicals. Note that in each case the metals, magnesium and sodium, carry positive charges.

Now, you may ask, how do we know all this; how can we prove that this is what happens? We feel we know it because of what we can see happening when we pass an electric current through such a salt solution. This process we call electrolysis, and any substance that splits into electrically charged ions in this way we call an electrolyte. We know that opposite electric charges attract each other, so we should expect the metals which carry the positive charges to move toward the negative pole, or electrode, and the negatively charged chlorine or nitrate or sulfate ions to move toward the positive electrode. This is exactly what does happen. If we take a solution of copper chloride and pass an electric current through it we find that the negative electrode becomes covered with a beautiful layer of red metallic copper, and that at the positive electrode the green gas we know as chlorine is liberated. The negative electrode is called the cathode; the positive electrode is called the anode.

Of course, things may not stop there. We know that chlorine is a very active chemical element. Now when a chlorine ion gives up its borrowed electron it becomes a chlorine atom. (The chemist gives the name "nascent chlorine" to chlorine that is being born as an atom.) The nascent chlorine is exceedingly active. If we should use an iron rod as electrode, the chlorine would attack the iron and would corrode it. If we want to get the chlorine liberated as a gas, we have to use carbon for the electrode. The same sort of thing may happen at the other electrode. If we pass an electric current through a solution of ordinary salt, $NaCl$, the sodium ions, Na^+, come to the cathode to pick up their missing electron and become sodium atoms. As sodium atoms they immediately react with the water, H_2O, and form sodium hydroxide, $NaOH$, or caustic soda. The leftover hydrogen atoms bubble up as hydrogen gas.

AN EXPERIMENT WITH A COPPER SALT, A SILVER SALT AND A GOLD SALT

An ion of silver, Ag^+, will pick up one electron and become an atom. One atom of silver weighs 108 units. One ion of copper, Cu^{++}, needs two electrons before it can become an atom again; and this atom weighs 63½ units. Gold needs three electrons to change from ion to atom; and its atom weighs 197 units. Take, now, three solutions—a silver salt, a copper salt and a gold salt. Pass the same electric current through each of them. In the *same* space of time, therefore, we should expect to have deposited as metal 108 units of silver; one half of 63½, or 31¾, units of copper; and one-third of 197, or 65 ⅔, weight units of gold. If we make very careful measures this is exactly what we do find. The strange thing is that Faraday made these measurements and got the same answer more than a hundred years ago. At that time, however, no one knew the reason for the result. We have here another proof that our present ideas about the electrical nature of atoms are correct.

THE PROCESS BY WHICH AN ACID BECOMES IONIZED IS MORE COMPLICATED

Salts are not the only substances that break up and become "ionized." Acids do it, too; but here the picture of what happens is a little more complicated. We used to think that when any acid is dissolved in water, a hydrogen ion with a positive charge, H^+—actually a simple *proton*—splits off. That would naturally leave a negatively charged ion behind. Now most chemists seem to think that the proton alone may not exist in water, but that it may unite with one molecule of water to form the positively charged ion, H_3O^+, sometimes called hydronium. In some acids, such as hydrochloric and sulfuric acid, most of the hydrogen splits off and forms ions in the solution; and therefore we call water solutions of these acids *strong* acids. But in others, such as acetic acid, the hydrogen seems to prefer to stay with the acid molecule, and only relatively few split off to become ions, and so we call these *weak* acids.

PURE WATER DOES NOT IONIZE EASILY AND IS A POOR CONDUCTOR OF ELECTRICITY

Bases behave more as salts do: if we dissolve caustic soda, NaOH, in water, it becomes ionized into Na^+ and the negatively charged hydroxyl ion OH^-. Pure water itself also ionizes very, very little into one proton H^+ (which may unite with a water molecule to form a hydronium ion, H_3O^+) and one hydroxyl ion, OH^-. From very accurate measurements we know that there is only one of each of these ions for every 550,000,000 molecules of non-ionized water. That is why chemically pure water is such a very poor conductor of electricity. Water has the property of acting as a sort of brake on electric forces. If water gets between two electrically charged particles that attract each other it makes this force between them 80 times smaller than when there is just air between them. Benzene makes the force only a little more than twice as small. This helps to explain why water is a solvent which ionizes salts beautifully, and benzene is not. Look at it in this way—if we dissolve a salt in water, the electrically charged parts of it have the forces that hold them together diminished 80 times, so they can get away from each other quite easily and swim around freely, and that is why the salt molecule breaks up and "ionizes" in water. By breaking up into ions, the salt makes the water a conductor of electricity. Sugar, glycerin and many other molecules which we call organic (because they contain carbon) are made differently. There is no tendency to break up into ions, not even when in a watery solution.

CHLORINE GAS IS A DEADLY POISON, BUT IONS OF CHLORINE ARE USED TO PURIFY WATER

Remember, ions are very different from atoms. Chlorine gas, which contains atoms and molecules of chlorine is green, has a very unpleasant odor, and is even poisonous. Cl^- ions are odorless, colorless, and not only harmless, but beneficial. We swallow them at least three times a day, whenever we eat or drink anything, and without them we could not live. (Table salt dissolves into sodium ions and chlorine ions.) Hydrogen gas is a colorless, odorless, tasteless gas, but the ions which it produces in water have that strong, sour taste that characterizes all acids. Atoms of copper have that well-known reddish brown color, but ions of Cu^{++} in water take on a beautiful deep blue color. Metallic nickel, that is, atoms of nickel, are almost as shiny as silver, but Ni^{++} ions are deep emerald-green in color.

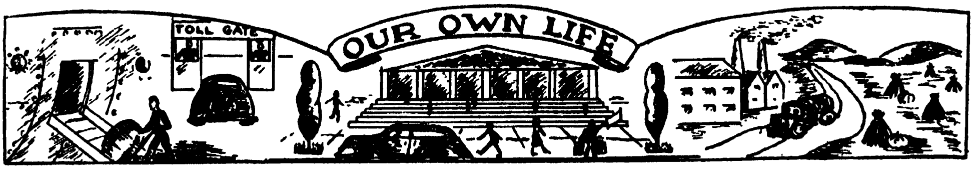
An atom is electrically balanced, or neutral; an ion always carries a negative or positive charge. On the other hand, most atoms have one or more too many or too few electrons in the outer shell; while ions have the shells complete. Ions have "structural balance."

No solution can ever contain only one kind of ion—for every positively charged sodium ion Na^+ there must be some kind of negatively charged ion, for a solution is always neutral.

A gas, as well as a solution, can become ionized.

By WILLEM J. LUYTEN.

THE NEXT STORY OF SCIENCE IS ON PAGE 6202.



TRADE BETWEEN NATIONS

YOU often hear it said that this is the age of specialization. People devote themselves entirely to particular jobs; so that perhaps your father makes shoes, a next-door neighbor may turn out a small but important part of an automobile, while your uncle may own a farm and raise fresh lettuce, radishes and onions for the near-by city.

This division of labor first began to appear in Europe during the fourteenth and fifteenth centuries, when great landowners commenced the practice of renting land to tenant farmers. Before that time each estate or family grew and manufactured most of the goods necessary to its needs. There was little trade, except in a few goods, such as salt and iron, which could not be found in every neighborhood. But aside from the purchase of such commodities, each manor or estate was largely self-sufficing.

As the great landowners rented out more and more of their land, and the great estates declined in size, number and importance, workers' guilds came into existence and rapidly grew. First came the merchant guilds which devoted themselves to trade. As the demand for goods expanded, craft guilds were created, each specializing in the making of some one product, as boots and shoes, bakery goods, cloth or iron products.

As trade and commerce grew, so did the demand for goods; and soon producers were looking for new and speedier ways to create commodities. This brought about the Industrial Revolution of the eighteenth and nineteenth centuries. As we know, many

Culver Service

Early colonists bartering with Indians. Traders often exchanged worthless trinkets for valuable American furs.

machines were invented in those centuries to do the work of many men and do it much more efficiently. Steam took the place of man-power and animal-power. Labor was divided still further. Instead of making a pair of shoes from start to finish, a man tended a machine that turned out a single part of the shoes, but did it very fast. This resulted in the creation of many new commodities in much less time and at a greatly decreased cost for labor. Lower costs meant lower prices. Lower prices meant that more people could afford to buy shoes, for instance. The demand for things increased all over the civilized world. More and more people began to make things for each other; the division of labor had come to stay; and buying and selling had become a major industry.

Our old friend Robinson Crusoe on his island did everything for himself (at least until Friday came) so that neither division of labor nor trade entered into his experience. However, imagine a hundred people living on an island. As soon as they began to divide their labor among different occupations, the need for exchange would spring up.

One man would make a weapon, and exchange it perhaps for a fish caught by another, or for some grain grown by a third. That would be a simple exchange of goods—we call it barter. When you exchange a pocket knife for some marbles, you are bartering. In early times, even in this country, most trade was conducted in the same manner. Today, to a very limited extent, barter is still used, as when the farmer brings a crate of eggs to a village store and in exchange receives from the storekeeper flour or sugar. During the depression days of the early 1930's in the Middle West of the United States, farmer boys who wanted very badly to go to college, but had no money, would sometimes pay their tuition in bushels of corn or potatoes.

The system of barter is very inconvenient and cumbersome. Suppose, for example, that an opera singer needs a new costume. She doubtless would have difficulty in finding a shopkeeper who would be willing to exchange a dress for a song. The problem would immediately arise (assuming the merchant was willing to make such an exchange) as to how long she must sing, or how many songs must be sung, to pay for the dress. This same situation would repeatedly arise as the musician sought to exchange her talent for other goods and services.

Such a system of barter today would compel every merchant to list the exchange or barter value of every article in the store for every other article that everyone else might have to sell. He would scarcely have room on his walls or ceiling for such a price list. It is very clear that under such limitations trade and commerce as we know it

Culver Service

A Turkish caravan of the Middle Ages, at a ford. Traders traveled in bands, for protection against robbers.

today certainly would be utterly impossible.

Very early it was realized that some other method of transfer had to be invented, a "common denominator" had to be provided for the purpose of measuring and stating values. So, instead of saying that a hat is worth so many pounds of sugar, or so many pairs of socks, we price all of these things in *money*. We say a hat costs so many dollars, and sugar so many cents a pound. With enough money in their pockets people can buy whatever they wish; so they are very willing to exchange their commodities for your money. Today trade is greatly simplified through the universally acceptable commodity—money.

THE IMPORTANCE OF TRADE IN OUR WORLD TODAY

Trade is exceedingly important, for it takes a thing from where it is made to where it is needed; and until a thing can be placed in the hands of a person who wants or needs it, it has not really become useful. This is a very important fact in economics. It may be said with truth that wealth is matter in the right place at the right time; and the matter can be gotten into the right place at the right time by some means of exchange.

We can remind ourselves how important it is to transfer things from places where they are not wanted to places where they are wanted by a very simple story. Some winters ago a college made elaborate plans for a week end of winter sports, which of course included tobogganing and skiing. Unfortunately, in mid-week a sudden warm spell melted all the snow. In order not to disappoint the students and the guests who were coming to enjoy the events, thousands of dollars were spent to bring in a trainload of snow from the northern part of the state, where it was so deep that highways were blocked and transportation was greatly restricted. That was an instance of giving great value to a commodity by bringing it from a place where it was not wanted to a place where it was very greatly desired.

Every working day men are busy all over the world, planting, reaping and manufacturing things to be transported by land or sea or air to places where they are needed. Engineers make roads, railways, vehicles, ships, barges and planes to assist transport, and the world presents a picture of mountains of goods of all sorts being carried from place to place to satisfy human needs. Where once a few barbarians doing little or no trading gained a meager living, great populations exist because of the trade which has been built up.

The need for trade, or exchange, is so great that if we were all making things, we should make them in vain. People would simply be piling up goods which would serve no useful purpose. That is why a very large proportion of the population is needed, not to make things, but to carry them or to deal in them or to work in some other way, as in a bank, to help trade.

Perhaps you may remember having driven along a country road with your father just before Thanksgiving Day and seeing an especially fine large yellow pumpkin in a farmer's field. The farmer may want very badly to sell it, and back in town your mother may want very badly to have just such a pumpkin, and she has the money to pay for it. However, until it has been made into a pie and is on your table, that pumpkin is of little value to anyone. In economics this problem of getting the pumpkin (and other commodities) to the consumer, or final user, is called the problem of distribution.

THE RAILROAD MAN IS AS USEFUL AS THE FARMER

Think of the millions of people who must be employed in making and repairing roads, docks, harbors and railways used in the transportation of goods, and in building and repairing or working in warehouses, stores, shops and offices concerned with the storage and sale of goods. A man working on a railway and helping to take the farmers' pumpkins or cabbage and other products from a section where they are plentiful to the city, where they are scarce, is just as necessary as the farmer. If the railroad or truck did not transport these commodities, it would be useless for the farmer to raise them.

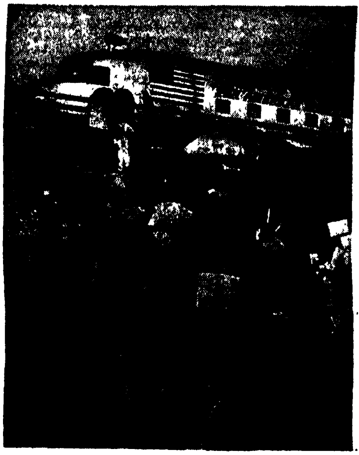
To go a step further, it would be useless either for the railway to carry the farm produce or for the farmer to raise it, if wholesale and retail stores were not set up where the people of a community could buy the pumpkins, cabbage, potatoes and other foods when they are wanted. So it is with other commodities. They have not only to be produced, and carried by sea and land and air to where there is a demand for them, but they must also be stored and then offered for sale in conveniently located markets and shops. From this we can see that the more simple the distribution and exchange of goods is, the better it is for all concerned. It is only common sense to see that if a commodity must pass through many hands before reaching the final consumer the price must necessarily be higher.

Today in the United States about half of the population over ten years of age is "gainfully employed." Of course, the proportion is much greater at some times, as during World War II, for example. Under normal conditions, however, about half of the population is gainfully at work. The other half includes the women at home who do not work for wages, small children, young people in school, people unable to work because of illness or old age, the relatively small class who do not need to work, and a few others. Of the many millions who are "employed gainfully" part are engaged in producing things—that is to say, they are either miners or quarrymen getting out coal, ores and stone; or agricultural workers producing food; or fishermen; or industrial workers producing metals, engines, machinery, tools, textiles, earthenware, rubber goods and other articles. The rest of the gainfully employed workers are engaged either in governing or in seeing that the law is obeyed; or in transporting of things by road, rail, river, sea or air; or in wholesale or retail buying and selling; or in banking and insurance; or in teaching; or in caring for our health; or in amusing us in theaters and moving-picture houses, and so on.

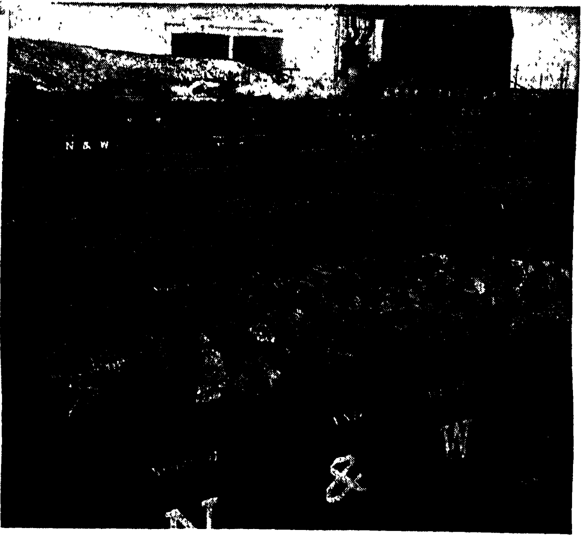
Sometimes the word "producer" is applied only to those who grow or make things. Actually everyone who does useful service is

Chesapeake and Ohio Ry.
Coal is transferred from train to ship.

American Trucking Association, Inc.
Huge motor vans carry goods across the breadth of the land.

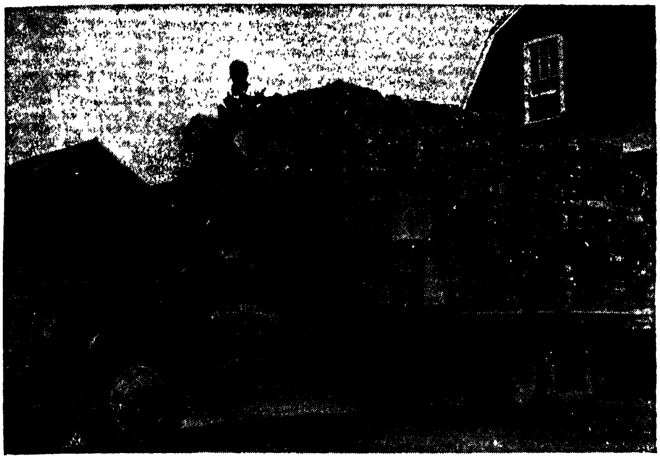


Pan American Airways;
Planes carry all sorts of freight, from eggs to machinery.



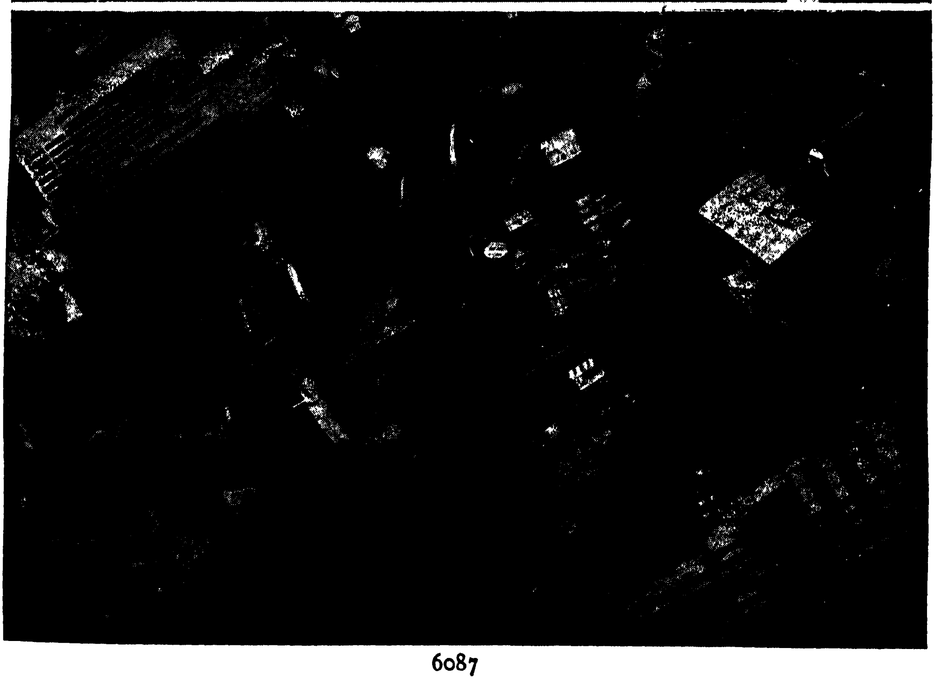
Norfolk and Western Ry.
Coal is graded by size before it is shipped.

FROM COUNTRY GARDEN TO CITY MARKET



Fruits and vegetables, picked and packed in the afternoon, leave the farm early the next morning by truck.

In the center picture the crates of fruit and vegetables are being loaded in refrigerator cars where their freshness will be preserved until they arrive at their destination (bottom picture), the city market, miles away.



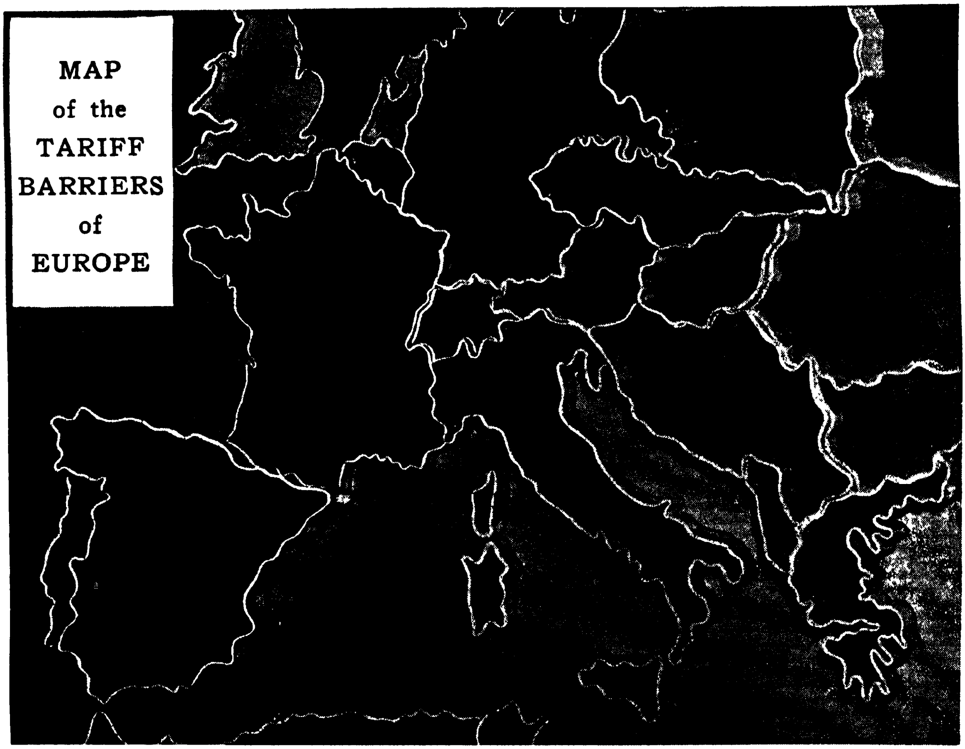
a producer, whether or not he actually works in agriculture or manufacturing, because all useful work helps production. We have just seen that it would be useless for the farmer to raise pumpkins if the railway or truck did not transport them, or if the merchant did not deal in them; and the man who brings the pumpkin to our door is just as much a producer as the man who guided the plow or the cultivator, and finally brought the produce in from the field.

It is equally true that if school teachers did not teach, if doctors did not attend to our health, and dentists did not take care of our teeth, if wholesale merchants did not buy and sell in big quantities, and if retail shops were not conveniently located, production would be less successful.

Sometimes people who trade in goods are called *middle-men;* and sometimes the term is used in a reproachful way, as if it were a reproach to deal in goods rather than to make them. This reproach is not deserved if the middle-man's business is well organized, and if he deals fairly with those he serves. The work of merchants, agents, brokers, bankers, insurance men and other commercial workers is indispensable under present conditions. It provides goods at the points where they are needed, and gives us the useful distribution of articles after they are made.

The banker helps buyers and sellers; he takes a real part in production. The lawyer who interprets the law, or settles a dispute, either by private negotiation or by conducting a lawsuit, is equally indispensable in the present state of society. The actor or singer may also claim to help in production because he amuses and cheers the life of his fellow-men and helps them to work to better advantage.

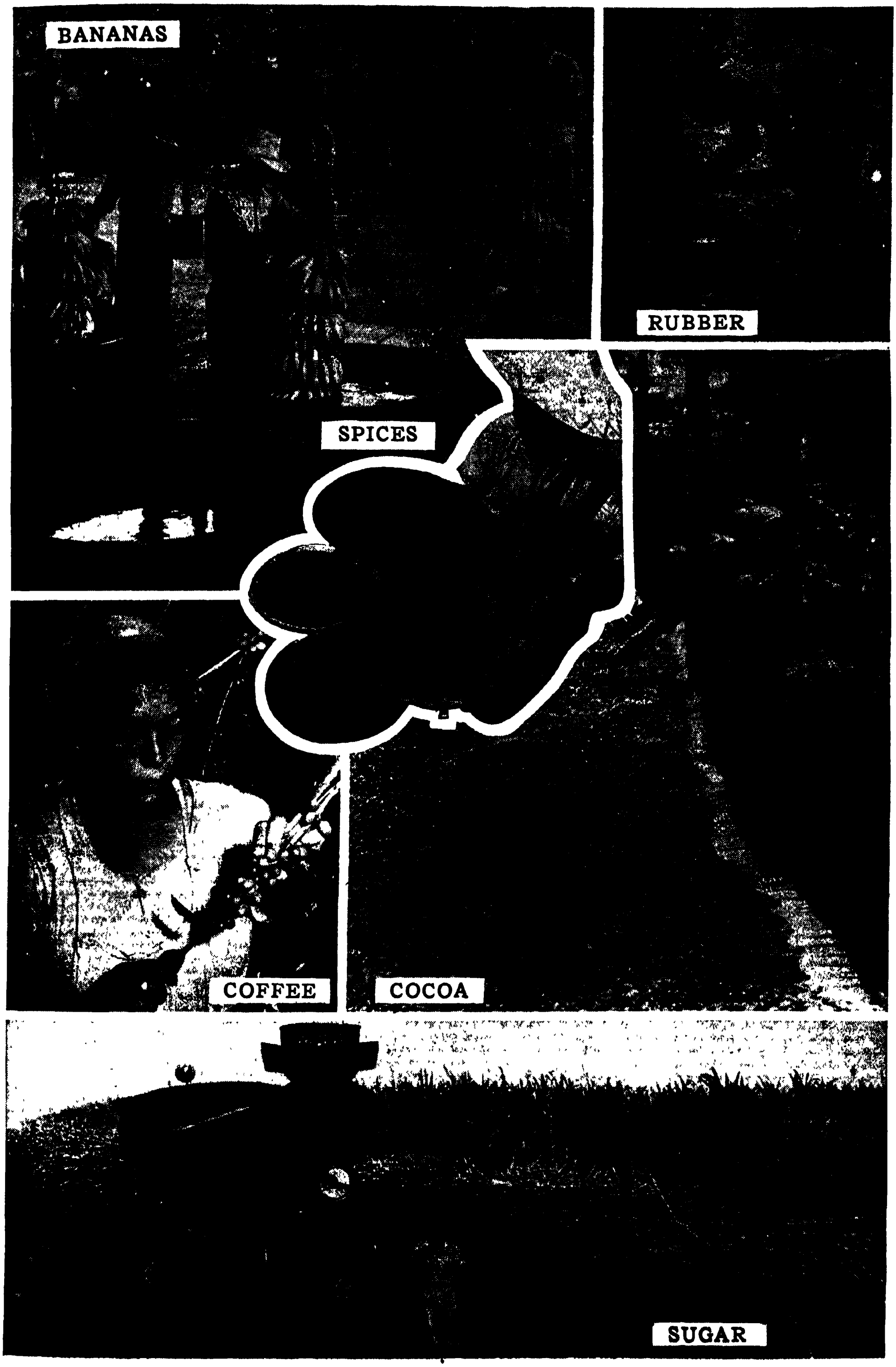
Throughout our history the importance of the middle-man has been steadily growing as a result of the ever increasing division of labor. Less than one hundred years ago only about a quarter of those classed as gainfully employed in the United States were middle-



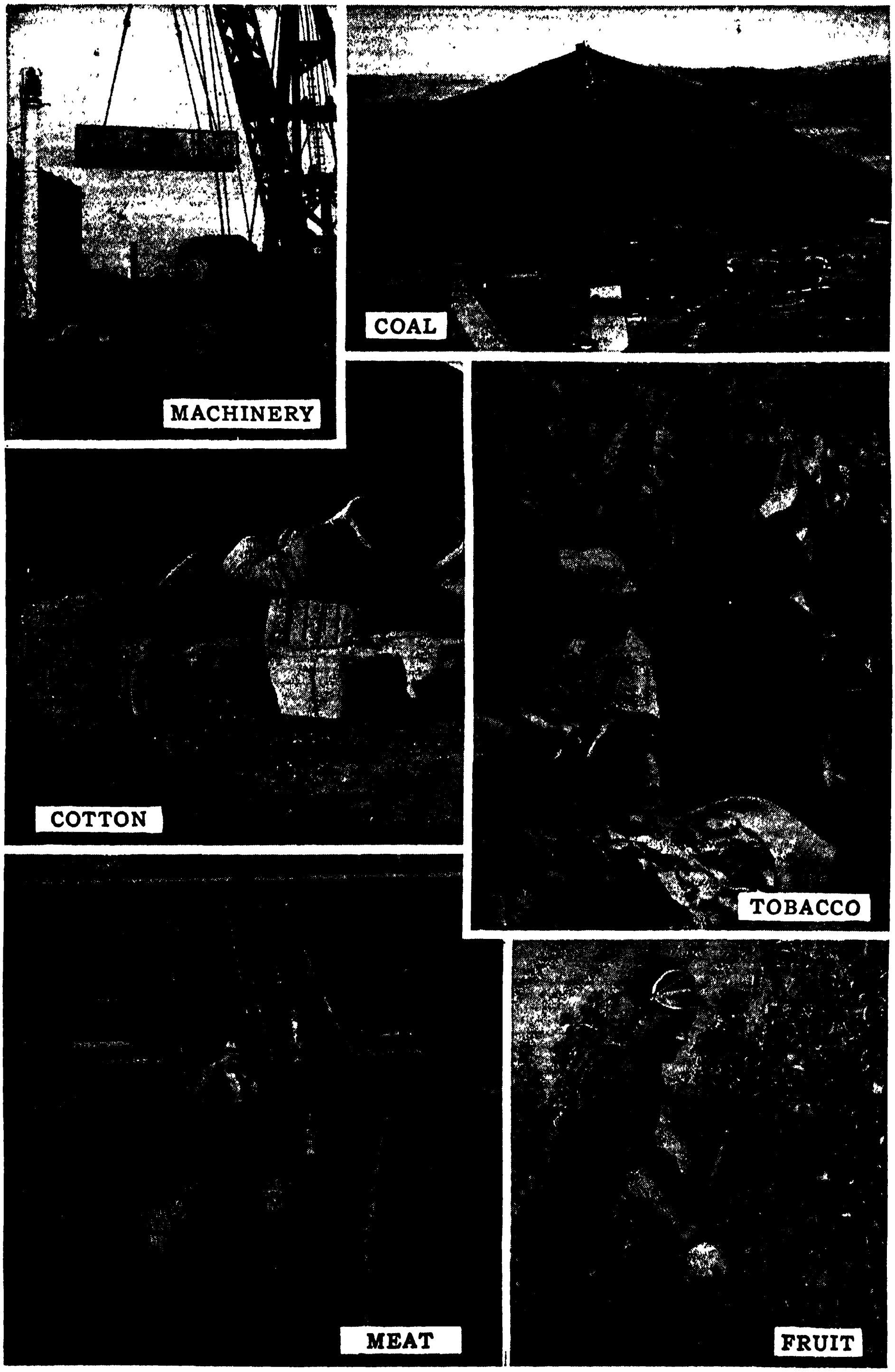
Oliver K. Whiting map

Part of the continent of Europe showing tariff walls. You can see at a glance how difficult the flow of trade must be. The general rule is that where tariff walls are low, the people live well.

PRODUCTS WE MUST IMPORT FROM SOUTHERN NEIGHBORS



SOME UNITED STATES EXPORTS



men. Today fully 50 per cent are employed in the process of transferring the newly created goods to the consumers who want them.

HOW THE MIDDLEMAN DETERMINES THE COST OF A PRODUCT

A considerable part of every dollar that consumers spend goes to the distributor. You may, for example, hear a farmer friend complain because the bunch of carrots he sold for one cent is sold across the counter of the grocery store for five cents. The pair of shoes costing $4 to produce may be sold to your father for $8; and the gallon of gasoline that goes into your automobile tank sells at three times the cost of producing it. Actually, on the average, fifty-nine cents out of every dollar we spend goes to the middle-man to cover the costs of getting the completed product into our hands. These charges, some say, are entirely disproportional to the services rendered. While that would be difficult to prove, it is true, however, that better organization might reduce the number of middle-men, and so help us to obtain a better distribution of commodities.

The following final illustration should drive home to you the fact that the middleman is a very important link in the production process, not only in the country as a whole, but even in your very own town. Do you remember that during the winter of 1944-45 there was a great deal of snow in many parts of the United States and Canada; and also that the war needs were taking more and more men out of peacetime jobs? Your father may have come up from the basement after fixing the furnace for the night, saying something like this, "Well, Mother, we have just about enough coal to last for two more days. I don't know what we're going to do. I called the coal dealer again today and he said he can not do a thing for us right now, but will get us a quarter of a ton as soon as he can. He said that three of his six coal trucks are in the garage because he can not get men to operate them. Besides, there has been so much snow that the railroad can't get coal trains through to our town." Perhaps it was decided to close some rooms off to save heat; and you may have slept on the sofa in the living-room. You can readily realize, if you went through such an experience, that the middle-man, the dealer, is very, very important to your health and comfort.

No small part of the wealth of a modern country arises from successful trading in commodities which it does not itself produce. Great Britain, for example, had by 1940 become the greatest market in the world for the products of many foreign countries, such as wool, tea, cocoa, rice, spices, tobacco, cotton, hemp, jute, hides, rubber and ivory. The trade in such things as these is very profitable to shipowners, merchants and warehousemen, and gives employment to many thousands of workers.

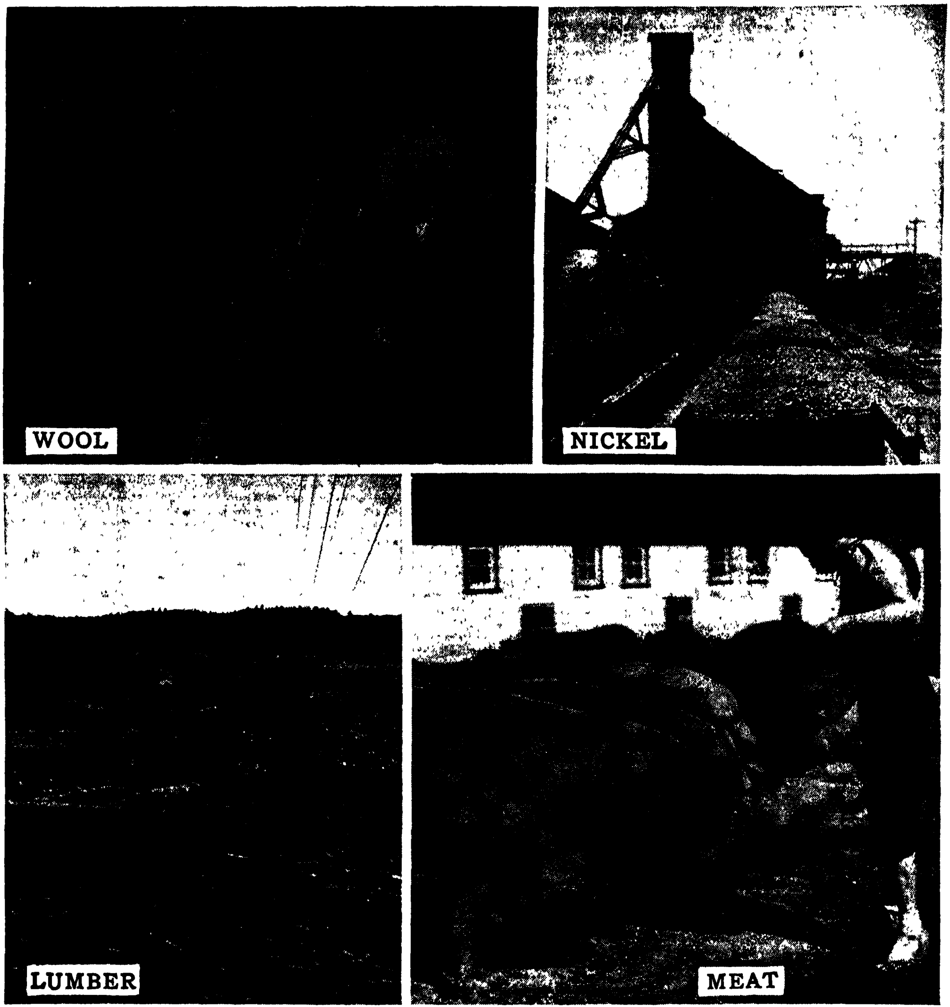
WHY FOREIGN TRADE IS IMPORTANT

The United States is very large and a very wealthy country. Before World War II there were many people who felt that since this was so, it was not necessary to depend upon other countries for the necessities of life. Some people even went so far as to say that all foreign goods should be shut out. Now, let us see how a great nation would really get along if it were to follow this advice and buy only its own goods.

Do you remember what you had for breakfast this morning? Was everything you had produced within the borders of your own country? Perhaps your parents drank coffee, while you had cocoa. The coffee came from Colombia or Brazil in South America. The cocoa may also have come from South America, or possibly from Africa. These two commodities may have been packed in cans coated with tin. The tin came from Malaya. On your cereal you had cream and sugar. This sugar may have come from Cuba.

You will remember what happened to our source of rubber when Japan struck at the East Indies lands and islands from which rubber comes. Rubber tires became very scarce. Then scientists went to work to invent a rubber-like substance. But tires made of synthetic rubber cost much more than when the natural rubber is used. Even in the case of clothing most countries are partly dependent on certain foreign countries. Canada sells leather for shoes and wool for clothing to the United States. Even some of the newspaper articles urging people in the United States to "Buy American" were printed on paper made in Canada!

One of the many terrible and costly lessons taught by the war is that no country can live by itself. Foreign trade is important. Not only is it true that many things we need must come from foreign lands; it is equally true that we produce a great many commodities that the people of foreign countries need. Before the war the United States exported about 50 per cent of her cotton, 35



Don Coltman photo; Canadian National Railways; Jos. Michaud, through courtesy of Dept. of Lands and Forests, Quebec, Canada

The products shown above are some of Canada's exports. Wheat is another. All of the world's great countries sell abroad goods they produce in abundance, and buy from abroad goods that they need or want.

per cent of the tobacco crop, 25 per cent of the office supplies produced and slightly more than 30 per cent of the foodstuffs raised by her farmers. This was also true for many manufactured goods, such as automobiles and typewriters. By profits from its exports a country is able to pay for the many things it imports.

Every part of the United States and every part of Canada produces something that the people in foreign countries want. Likewise the people in every state of the Union and every province of the Dominion use goods that have been produced in foreign lands. Under the modern way of life no nation can successfully produce enough supplies to become independent of its neighbors. A nation may produce much more of a particular commodity than it can profitably use at home. Canada, for instance, has immense forests and can spare wood pulp and paper to the United States and Europe which need them. Both Canada and the United States raise more wheat and cattle than they can eat and sell some of these goods to hungry Europe.

On the other hand, though the United States makes more motor cars than all the rest of the world, it can not grow rubber, and without rubber the motor industry would be very greatly diminished. Neither Canada nor the United States can grow coffee, tea, silk, or spices with profit, and neither produces enough sugar for its needs. If we could not get these products elsewhere, thousands of people would be thrown out of employment and millions more would be uncomfortable.

The United States produces more oil than it can use, while Canada is the chief producer of nickel, which the United States needs. The latter can send oranges, lemons and grapefruit to Canada. Some of the furs which Canada does not need will more than pay for them. All over the civilized world the surplus of one country is sent to another, and in exchange necessary articles are received. No nation can live and prosper without using the products of others.

When the manner of life is simple and the wants of the people are few, a group of people can live almost without intercourse with other groups; but their state of civilization will not be high. One of the marks of an advancing civilization is the great increase in the number and in the kinds of things desired. The savage wants only a few things, while the civilized man wants many.

HIGH TARIFFS TEND TO LOWER STANDARDS OF LIVING

If high walls were built around each country, shutting off all communication with other nations, the level of comfort and civilization would go down. This was shown to be true following World War I, when many of the European countries raised high tariff walls. (A tariff wall is a government tax on goods coming into a country from foreign countries.) This was one of the reasons, economists tell us, why in the early 1930's the worst depression of modern times swept over much of the world.

Various countries tried to relieve the depression. One proposal was the Reciprocal Trade Plan, put forward by the United States. This plan had as its aim the increase of trade between all the nations in the civilized world. Some twenty nations entered into the plan, agreeing to reduce the duties on certain American products, and the United States extended the same privilege to certain goods which those countries wanted to ship to us.

Neither Germany nor Italy would cooperate in this plan, preferring to be, if they could, independent of the rest of the world. They soon realized that this policy would not work. They needed buyers for their goods. Italy then invaded Ethiopia in order to obtain a colony that could be forced to buy Italian goods. Shortly thereafter Germany, under Hitler, adopted the same procedure. One by one, in rapid succession, German troops invaded the neighboring countries of Europe. Hitler's plan was to have Germany become the great, prosperous manufacturing center of Europe, with the other nations reduced to a state of agricultural servitude. Thus Germany would be self-sufficing at the expense of the rest of the world. We all know the terrific loss of life and the great suffering that resulted from the pursuit of such a wrong policy.

S.I.A.A. photo

A doctor's "services" form part of his country's production.

It is to be hoped that no nation will ever again follow the silly notion that it can stand alone, cut off from its neighbors. A large country like Canada or the United States or the Soviet Union could survive longest after adopting such a way of life; but there would be much discomfort. Surplus goods would pile up. Factories would close, and millions of people would be thrown out of work.

Where a country depends chiefly upon manufacturing and trade, conditions would be much worse. Great Britain is a small country with a large population for its size. It produces hardly a third of the food it eats, but buys food with coal from its mines, or with manufactured articles. Probably, if an end should be put to foreign trade, a greater quantity of food could be raised than at present, but not enough to support half the people who now live there. They would be forced to emigrate or starve.

In the summer of 1944, forty-four nations

Ewing Galloway

Port of Singapore. Ships from all over the world come to these busy docks.

sent representatives to a World Economic Conference held at Bretton Woods, New Hampshire. By that time much progress had been made in the war against Germany and Japan and leaders in many nations did not want to see the same mistakes made with the coming of peace that followed World War I. You know from your history that after 1918 some unfortunate things happened. Many of the great nations seemed to think, that the only way to have peace would be to stay away from each other and do everthing possible to promote political and economic self-sufficiency. We call this policy isolationism. The opposite policy is co-operation.

Believing that the only possible way to save world prosperity is by co-operation in trade and commerce, the delegates to this conference drew up a plan. It is known as the Bretton Woods Plan for World Economic Cooperation.

Before the definite plan was drawn up many ideas were proposed. One was that the monetary standards in each country (such as the dollar and the pound sterling) be abolished and an international standard, with an entirely new name, be adopted. The idea was too extreme to be accepted.

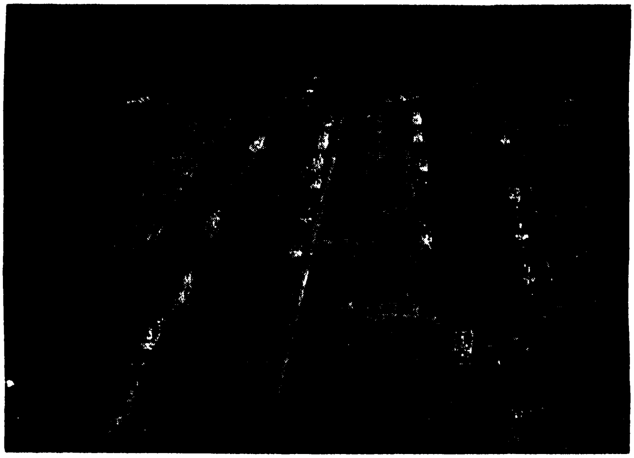
As finally adopted, the plan called for two devices. The first was an International Bank through which all financial arrangements connected with international trade must go. This, of course, would greatly simplify the problems of trade and commerce among nations.

The other device proposed was an International Stabilization Fund. This fund would be created through contributions of money by the nations. The money would go into a common pool. When necessary, money from the pool would be loaned on good security to help nations temporarily in need. Money would also be loaned to backward nations in the belief that if they could be made prosperous, the world as a whole would benefit.

The organization of the United Nations does include an International Bank, and an International Monetary Fund. So you see a start has been made. Time must test the plan. It is at least a great step in co-operation in international trade and finance.

Remember this—the greater the division of labor, the more dependent men become upon each other. Remember also that every passing year sees an increase in the division of labor.

By Graeme O'Geran.



The King George and Royal Albert Docks, London. This port is one of the greatest shipping centers in the world.

THE NEXT STORY OF OUR OWN LIFE IS ON PAGE 6359.

Santa Claus

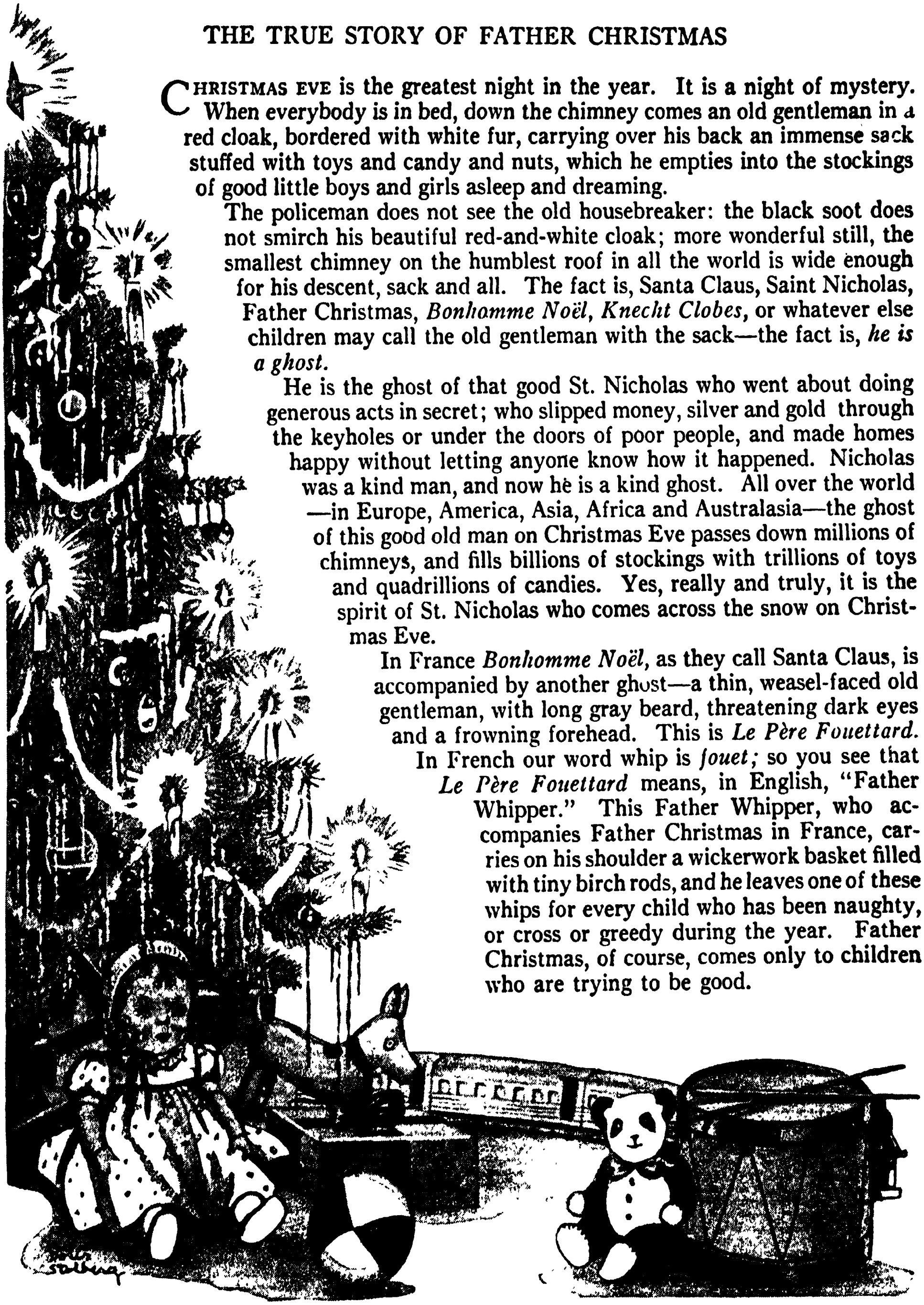
THE TRUE STORY OF FATHER CHRISTMAS

CHRISTMAS EVE is the greatest night in the year. It is a night of mystery. When everybody is in bed, down the chimney comes an old gentleman in a red cloak, bordered with white fur, carrying over his back an immense sack stuffed with toys and candy and nuts, which he empties into the stockings of good little boys and girls asleep and dreaming.

The policeman does not see the old housebreaker: the black soot does not smirch his beautiful red-and-white cloak; more wonderful still, the smallest chimney on the humblest roof in all the world is wide enough for his descent, sack and all. The fact is, Santa Claus, Saint Nicholas, Father Christmas, *Bonhomme Noël, Knecht Clobes,* or whatever else children may call the old gentleman with the sack—the fact is, *he is a ghost.*

He is the ghost of that good St. Nicholas who went about doing generous acts in secret; who slipped money, silver and gold through the keyholes or under the doors of poor people, and made homes happy without letting anyone know how it happened. Nicholas was a kind man, and now he is a kind ghost. All over the world —in Europe, America, Asia, Africa and Australasia—the ghost of this good old man on Christmas Eve passes down millions of chimneys, and fills billions of stockings with trillions of toys and quadrillions of candies. Yes, really and truly, it is the spirit of St. Nicholas who comes across the snow on Christmas Eve.

In France *Bonhomme Noël,* as they call Santa Claus, is accompanied by another ghost—a thin, weasel-faced old gentleman, with long gray beard, threatening dark eyes and a frowning forehead. This is *Le Père Fouettard.* In French our word whip is *Jouet;* so you see that *Le Père Fouettard* means, in English, "Father Whipper." This Father Whipper, who accompanies Father Christmas in France, carries on his shoulder a wickerwork basket filled with tiny birch rods, and he leaves one of these whips for every child who has been naughty, or cross or greedy during the year. Father Christmas, of course, comes only to children who are trying to be good.



There is still another difference in France. Children do not hang up their stockings on Christmas Eve; instead they put little sabots, which are wooden shoes, in front of the hearth, close to the chimney by which Father Christmas descends. If you have read Victor Hugo's wonderful book *Les Misérables*, you will remember the story of the poor little ill-treated girl who put her shoes on the hearth year after year, and never received anything till St. Nicholas, in the shape of a poor but good man who had been in prison, visited the scene of her misery and gave her happiness.

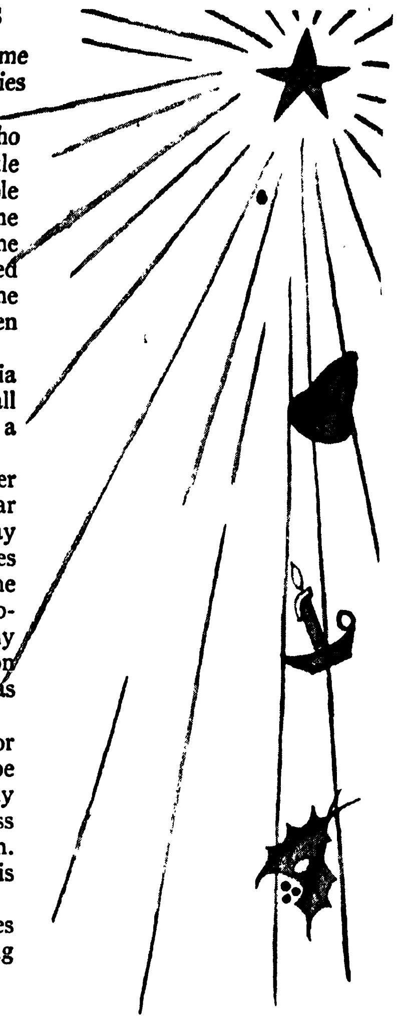
And this is the real mystery.

Santa Claus very often takes a human form. There are so many chimneys in the world, and children will wake up so dreadfully early on Christmas morning, that nowadays even a ghost has not time to go all round the world in a single night. So the ghost of St. Nicholas splits itself up into little atoms of kindness, and these atoms, like seed thrown from a sower's hand, take root in the hearts of fathers and mothers, and uncles and aunts, and guardians and friends, and turns them all, on Christmas Eve, into Santa Clauses.

And this, you will see, is the true explanation of Santa Claus. Perhaps it is only in very old-fashioned, out-of-the-way places that Father Christmas really rides about on a donkey, or in a sleigh pulled by reindeer, and climbs on roofs, and descends down the chimney with his sack of toys. But if there had never been a St. Nicholas, who was a real man, no stockings and no sabots would ever have been set out on Christmas Eves for surprise gifts. So it is still a mystery.

If you keep half an eye open this Christmas Eve and see, while you pretend to be fast asleep, your father and mother enter the room with parcels of toys, candies and oranges, just say to yourself that Santa Claus is *employing* them to do his will, and that if St. Nicholas had not lived and done kindly things, you would never have had that box of soldiers, that automobile, that farmyard, that grocer's shop, that doll, that sled, that book of fairy tales, those skates and that model airplane on Christmas morning.

Do not think that you are very sharp and



clever to have found out how the toys and candies come to you on Christmas Eve. It is one of the great mysteries of life.

For once upon a time there lived a rich young man who tried, because he so much admired the kind and gentle character of Christ, to make his money give other people happiness. He went about placing coins and gifts in the homes of poor people. He did good in secret. The name of this young man was Nicholas. We know that he lived long, long ago, in the fourth century after the birth of the Christ Child. Too many years have passed since then for us to know very much about him.

The legends tell us he dwelt afar, in the land of Asia Minor. After this good, kind Nicholas had given away all his gold and silver, he entered a monastery. He became a bishop, and by and by he became a saint.

Children and grownups have loved St. Nicholas ever since. It may be that there is no saint quite so popular with everybody. In some countries he has a special day all his own. Then a man dressed like St. Nicholas rides about on a fine white horse and gives presents to all the boys and girls who come clamoring around him. St. Nicholas is the special guardian of children and sailors. Many churches have been built in his honor, and he is the patron saint of Russia. In southern Italy the Feast of St. Nicholas is a splendid and happy festival.

So that one man whom men call St. Nicholas has, for hundreds of years, inspired the whole civilized world to be kind and generous on Christmas Eve. He was not a mighty warrior, but he has done more for the happiness, kindness and good humor of the world than Cæsar or Napoleon. Is that not a far greater mystery than Santa Claus and his donkey or his reindeer?

Learn from this story that Santa Claus, even if he comes in your father's or your mother's person, is still the loving spirit of the good Nicholas.

THE NEXT STORIES ARE ON PAGE 6317

Poems of Christmas

Christmas Carol

Edmund Hamilton Sears (1810-1876), an American Unitarian clergyman, wrote this hymn. It is one of the loveliest of Christmas songs, for it seems to breathe the true spirit of joy and wonder and hope; of peace on earth and good will toward men, that we should all feel on this day.

It came upon the midnight clear,
That glorious song of old,
From angels bending near the earth
To touch their harps of gold:
"Peace on the earth, good will to men
From heaven's all-gracious King"—
The world in solemn stillness lay
To hear the angels sing.

Still through the cloven skies they come
With peaceful wings unfurled,
And still their heavenly music floats
O'er all the weary world;
Above its sad and lowly plains
They bend on hovering wing,
And ever o'er its Babel-sounds
The blessèd angels sing.

But with the woes of sin and strife
The world has suffered long;
Beneath the angel-strain have rolled
Two thousand years of wrong;
And man, at war with man, hears not
The love-song which they bring;—
Oh, hush the noise, ye men of strife,
And hear the angels sing!

For lo! the days are hastening on
By prophet bards foretold,
When with the ever circling years
Comes round the age of gold;
When Peace shall over all the earth
Its ancient splendors fling,
And the whole world give back the song
Which now the angels sing.

O Little Town of Bethlehem

Phillips Brooks (1835-1893), an American Episcopal bishop, wrote this carol in 1868, for the children of the Church of the Advent, in Philadelphia, the first church of which he became rector. It has come to be one of the best loved of all our Christmas songs.

O LITTLE town of Bethlehem,
How still we see thee lie!
Above thy deep and dreamless sleep
The silent stars go by;
Yet in thy dark streets shineth
The everlasting Light;
The hopes and fears of all the years
Are met in thee to-night.

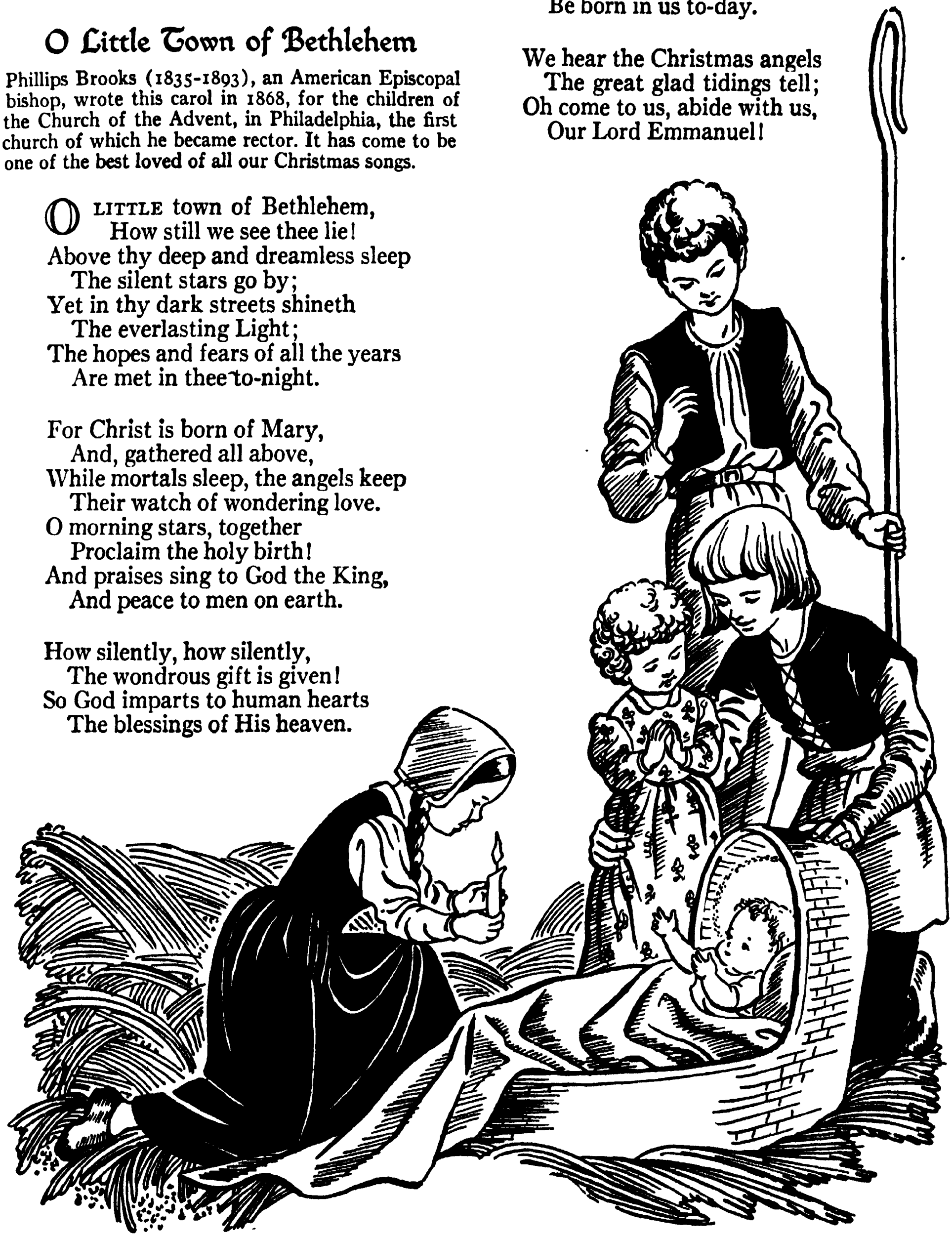
For Christ is born of Mary,
And, gathered all above,
While mortals sleep, the angels keep
Their watch of wondering love.
O morning stars, together
Proclaim the holy birth!
And praises sing to God the King,
And peace to men on earth.

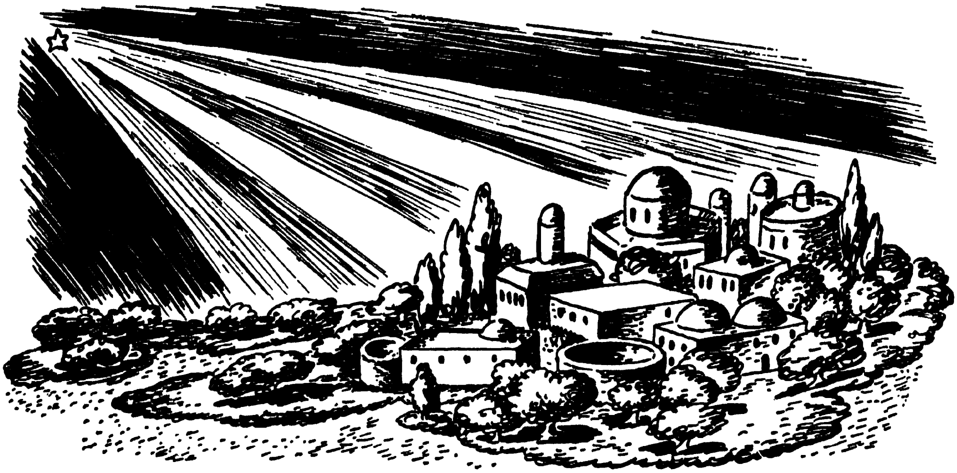
How silently, how silently,
The wondrous gift is given!
So God imparts to human hearts
The blessings of His heaven.

No ear may hear His coming,
But in this world of sin,
Where meek souls will receive Him still,
The dear Christ enters in.

O holy Child of Bethlehem!
Descend to us, we pray;
Cast out our sin, and enter in,
Be born in us to-day.

We hear the Christmas angels
The great glad tidings tell;
Oh come to us, abide with us,
Our Lord Emmanuel!





The First Nowell

No one now knows who wrote this old carol. Old English had many French words in it, and Nowell comes from the French name for Christmas, *Noël.*

The first Nowell the Angels did say,
Was to certain poor shepherds in fields as they lay;
In fields where they lay, keeping their sheep,
On a cold winter's night that was so deep.
Nowell, Nowell, Nowell, Nowell,
Born is the King of Israel.

They lookèd up and saw a star,
Shining in the East beyond them afar;
And to the earth it gave great light,
And so it continued both day and night.
Nowell, Nowell, Nowell, Nowell,
Born is the King of Israel.

And by the light of that same star,
Three Wise Men came from country far;
To seek for a King was their intent,
And to follow the star wherever it went.
Nowell, Nowell, Nowell, Nowell,
Born is the King of Israel.

The star drew nigh to the northwest,
O'er Bethlehem it took its rest;
And there it did both stop and stay,
Right over the place where Jesus lay.
Nowell, Nowell, Nowell, Nowell,
Born is the King of Israel.

Then did they know assuredly
Within that house the King did lie;
One entered in then for to see
And found the Babe in poverty.
Nowell, Nowell, Nowell, Nowell,
Born is the King of Israel.

Then entered in those Wise Men three
Most reverently upon their knee,
And offered there in His presence
Both gold and myrrh, and frankincense.
Nowell, Nowell, Nowell, Nowell,
Born is the King of Israel.

Between an ox-stall and an ass
This Child, truly there, born He was;
For want of clothing they did Him lay
All in the manger among the hay.
Nowell, Nowell, Nowell, Nowell,
Born is the King of Israel.

Then let us all with one accord
Sing praises to our heavenly Lord,
That hath made heaven and earth of nought,
And with His blood mankind hath bought.
Nowell, Nowell, Nowell, Nowell,
Born is the King of Israel.

Silent Night

Father Joseph Mohr (1792-1848), a Catholic priest of Hallein, in the Austrian Alps, wrote this on Christmas Eve, 1818, to be sung by the children of the village.

Silent night! holy night!
All is calm, all is bright.
'Round yon Virgin Mother and Child,
Holy Infant so tender and mild,
Sleep in heavenly peace.
Sleep in heavenly peace.

Silent night! holy night!
Shepherds quake at the sight!
Glories stream from heaven afar,
Heavenly hosts sing Alleluia;
Christ the Saviour is born.
Christ the Saviour is born.

Silent night! holy night!
Son of God, love's pure light
Radiant beams from Thy holy face,
With the dawn of redeeming grace,
Jesus, Lord, at Thy birth.
Jesus, Lord, at Thy birth.

God Rest You Merry, Gentlemen

This is a traditional carol; that is, one that people have sung for centuries, and the original author of which has long ago been forgotten.

God rest you merry, gentlemen,
Let nothing you dismay,
For Jesus Christ, our Saviour,
Was born upon this day,
To save us all from Satan's power
When we were gone astray.

O tidings of comfort and joy!
For Jesus Christ, our Saviour,
Was born on Christmas Day.

In Bethlehem, in Jewry,
This blessèd Babe was born,
And laid within a manger,
Upon this blessèd morn;
The which His mother, Mary,
Nothing did take in scorn.

From God our Heavenly Father,
A blessèd Angel came,
And unto certain shepherds
Brought tidings of the same;
How that in Bethlehem was born
The Son of God by name.

"Fear not," then said the Angel,
"Let nothing you affright.
This day is born a Saviour,
Of virtue, power and might,
So frequently to vanquish all
The friends of Satan quite."

The shepherds, at those tidings,
Rejoicèd much in mind,
And left their flocks a-feeding
In tempest, storm, and wind;
And went to Bethlehem straightway
This blessèd Babe to find.

But when to Bethlehem they came,
Whereat this Infant lay,
They found Him in a manger,
Where oxen feed on hay;
His mother Mary kneeling,
Unto the Lord did pray.

Now to the Lord sing praises,
All you within this place,
And with true love and brotherhood
Each other now embrace;
This holy tide of Christmas
All others doth deface.

O tidings of comfort and joy!
For Jesus Christ, our Saviour,
Was born on Christmas Day.

The Three Kings

Henry Wadsworth Longfellow (1807-1882), who wrote this, was a beloved American poet. Many of his poems are especially loved by children. Here he tells the wonderful story of the Three Wise Men who followed the star to Bethlehem, long centuries ago.

THREE Kings came riding from far away,
Melchior and Gaspar and Baltasar;
Three Wise Men out of the East were they,
And they travelled by night and they slept by day,
For their guide was a beautiful. wonderful star.

The star was so beautiful, large and clear,
That all the other stars of the sky
Became a white mist in the atmosphere;
And by this they knew that the coming was near
Of the Prince foretold in the prophecy.

Three caskets they bore on their saddle-bows,
Three caskets of gold with golden keys;
Their robes were of crimson silk, with rows
Of bells and pomegranates and furbelows,
Their turbans like blossoming almond-trees.

And so the Three Kings rode into the West,
Through the dusk of night, over hill and dell,
And sometimes they nodded with beard on breast,
And sometimes talked, as they paused to rest,
With the people they met at some wayside well.

"Of the child that is born," said Baltasar,
"Good people, I pray you, tell us the news,
For we in the East have seen his star,
And have ridden fast, and have ridden far,
To find and worship the King of the Jews."

And the people answered, "You ask in vain;
We know of no king but Herod the Great!"
They thought the Wise Men were men insane,
As they spurred their horses across the plain
Like riders in haste, and who cannot wait.

And when they came to Jerusalem,
Herod the Great, who had heard this thing,
Sent for the Wise Men and questioned them;
And said, "Go down unto Bethlehem,
And bring me tidings of this new king."

So they rode away, and the star stood still,
The only one in the gray of morn;
Yes, it stopped,—it stood still of its own free will,
Right over Bethlehem on the hill,
The city of David, where Christ was born.

And the Three Kings rode through the gate and the guard,
Through the silent street, till their horses turned
And neighed as they entered the great inn-yard;
But the windows were closed, and the doors were barred,
And only a light in the stable burned.

And cradled there in the scented hay,
In the air made sweet by the breath of kine,
The little child in the manger lay,
The Child that would be King one day
Of a kingdom not human, but divine.

His mother, Mary of Nazareth,
Sat watching beside his place of rest,

Watching the even flow of his breath,
For the joy of life and the terror of death
Were mingled together in her breast.

They laid their offerings at his feet:
The gold was their tribute to a King;
The frankincense, with its odor sweet,
Was for the Priest, the Paraclete;
The myrrh for the body's burying.

And the mother wondered and bowed her head,
And sat as still as a statue of stone;
Her heart was troubled yet comforted,
Remembering what the Angel had said
Of an endless reign and of David's throne.

Then the Kings rode out of the city gate,
With a clatter of hoofs in proud array;
But they went not back to Herod the Great,
For they knew his malice and feared his hate,
And returned to their homes by another way.

An Ancient Carol

We do not know who was the author of this lovely carol, but we do know that it is more than five hundred years old.

He came all so still
Where His mother was,
As dew in April
That falleth on the grass.

He came all so still
Where His mother lay,
As dew in April
That falleth on the spray.

He came all so still
To His mother's bower,
As dew in April
That falleth on the flower

Mother and maiden
Was never none but she!
Well might such a lady
God's mother be.

Adeste Fidelis

This translation of the Latin hymn, Adeste Fidelis (O Come, All Ye Faithful), was made by Canon Frederick Oakeley in the year 1841.

O COME, all ye faithful,
Joyful and triumphant,
O come ye, O come ye to Bethlehem;
Come and behold Him
Born, the King of angels;
O come let us adore Him,
O come let us adore Him,
O come let us adore Him, Christ the Lord.

God of God,
Light of Light,
Lo, He abhors not the Virgin's womb;
Very God,
Begotten, not created;
O come let us adore Him,
O come let us adore Him,
O come let us adore Him, Christ the Lord.

Sing, choirs of angels,
Sing in exultation,
Sing, all ye citizens of heaven above,
Glory to God
In the highest:
O come let us adore Him,
O come let us adore Him,
O come let us adore Him, Christ the Lord.

Yea, Lord we greet Thee,
Born this happy morning;
Jesu, to Thee be glory given;
Word of the Father,
Now in flesh appearing;
O come let us adore Him,
O come let us adore Him,
O come let us adore Him, Christ the Lord.

Hark! The Herald Angels Sing

This Christmas hymn of joy and praise is almost always sung as a processional at Christmas services. It was written by Charles Wesley (1707-1788) the brother of John Wesley and one of the founders of Methodism. Charles Wesley is said to have written nearly a thousand hymns, but only a few are still sung.

HARK! the herald angels sing,
Glory to the new-born King,
Peace on earth, and mercy mild,
God and sinners reconciled.
Joyful, all ye nations, rise,
Join the triumph of the skies;
With the angelic host proclaim,
'Christ is born in Bethlehem.'
Hark! the herald angels sing
Glory to the new-born King.

Christ, by highest heaven adored,
Christ, the everlasting Lord,
Late in time behold Him come,
Offspring of a Virgin's womb.
Veiled in flesh the Godhead see!
Hail, the incarnate Deity!
Pleased as Man with man to dwell,
Jesus, our Emmanuel.
Hark! the herald angels sing
Glory to the new-born King.

Hail, the heaven-born Prince of peace!
Hail, the Sun of righteousness!
Light and life to all He brings,
Risen with healing in His wings.
Mild He lays His glory by,
Born that man no more may die,
Born to raise the sons of earth,
Born to give them second birth.
Hark! the herald angels sing
Glory to the new-born King.

Once In Royal David's City

Cecil Frances Alexander (1818-1895), who wrote this Christmas song, was the wife of the Anglican Bishop of Derry, in Ireland. She was famous for her religious and charitable work, and she wrote a number of hymns and religious poems. This is perhaps the best loved and best known of all her hymns.

ONCE in royal David's city
  Stood a lowly cattle shed,
Where a Mother laid her Baby
  In a manger for His bed;
Mary was that Mother mild,
Jesus Christ her little Child.

He came down to earth from Heaven
  Who is God and Lord of all,
And His shelter was a stable,
  And His cradle was a stall;
With the poor and mean and lowly,
Lived on earth our Savior holy.

And, through all His wondrous Childhood
  He would honor and obey,
Love and watch the lowly Maiden
  In whose gentle arms He lay;
Christian children all must be
Mild, obedient, good as He.

For He is our childhood's pattern,
  Day by day, like us he grew;
He was little, weak, and helpless,
  Tears and smiles like us He knew.
And He feeleth for our sadness.
And He shareth in our gladness.

And our eyes at last shall see Him,
  Through His own redeeming love;
For that Child so dear and gentle
  Is our Lord in heaven above.
And He leads His children on
To the place where He is gone.

Not in that poor lowly stable,
  With the oxen standing by,
We shall see Him; but in Heaven,
  Set at God's right hand on high;
When like stars His children crowned
All in white shall wait around.

As Joseph Was A-Waukin'

No one knows who the poet was who wrote these lovely verses hundreds of years ago, but he had a rare gift for beauty and simplicity of expression. Part of the carol's charm lies in the shining tenderness of the wording. Note the old Anglo-Saxon word-endings, such as "housen" for "houses."

AS Joseph was a-waukin',
  He heard an angel sing,
"This night shall be the birthnight
  Of Christ our heavenly King.

"His birth-bed shall be neither
  In housen nor in hall,
Nor in the place of paradise,
  But in the oxen's stall.

"He neither shall be rockèd
  In silver nor in gold,
But in the wooden manger
  That lieth in the mould.

"He neither shall be washen
  With white wine nor with red,
But with the fair spring water
  That on you shall be shed.

"He neither shall be clothèd
  In purple nor in pall,
But in the fair white linen
  That usen babies all."

As Joseph was a-waukin',
  Thus did the angel sing,
And Mary's Son at midnight
  Was born to be our King.

Then be you glad, good people,
  At this time of the year;
And light you up your candles,
  For His star it shineth clear.

As Joseph was a-waukin',
  He heard an angel sing,
"This night shall be the birthnight
  Of Christ our heavenly King."

A Visit From St. Nicholas

Clement Clarke Moore (1779-1863), a clergyman who lived in New York, wrote these Christmas verses for his own children in 1822.

'TWAS the night before Christmas, when all through the house
Not a creature was stirring, not even a mouse;
The stockings were hung by the chimney with care,
In hopes that ST. NICHOLAS soon would be there;
The children were nestled all snug in their beds,
While visions of sugarplums danced in their heads;
And mama in her 'kerchief and I in my cap,
Had just settled our brains for a long winter's nap,
When out on the lawn there arose such a clatter,
I sprang from my bed to see what was the matter.
Away to the window I flew like a flash,
Tore open the shutters and threw up the sash.
The moon on the breast of the new-fallen snow
Gave the lustre of mid-day to objects below,
When, what to my wondering eyes should appear,
But a miniature sleigh and eight tiny reindeer,
With a little old driver, so lively and quick,
I know in a moment it must be St. Nick.

More rapid than eagles his coursers they came,
And he whistled, and shouted, and called them by name;
"Now, *Dasher!* now, *Dancer!* now, *Prancer* and *Vixen!*
On, *Comet!* on *Cupid!* on *Donder* and *Blitzen!*
To the top of the porch! to the top of the wall!
Now dash away! dash away! dash away all!"
As dry leaves that before the wild hurricane fly,
When they meet with an obstacle, mount to the sky,
So up to the house-top the coursers they flew,
With the sleigh full of toys, and St. Nicholas too.

And then, in a twinkling, I heard on the roof
The prancing and pawing of each little hoof.
As I drew in my head, and was turning around,
Down the chimney St. Nicholas came with a bound.
He was dressed all in fur, from his head to his foot,
And his clothes were all tarnished with ashes and soot;
A bundle of toys he had flung on his back,
And he looked like a peddler just opening his pack.

His eyes—how they twinkled; his dimples how merry!
His cheeks were like roses, his nose like a cherry!
His droll little mouth was drawn up like a bow,
And the beard of his chin was as white as the snow;
The stump of a pipe he held tight in his teeth,
And the smoke it encircled his head like a wreath;
He had a broad face and a little round belly,
That shook, when he laughed, like a bowlful of jelly.
He was chubby and plump, a right jolly old elf,
And I laughed when I saw him, in spite of myself;
A wink of his eye and a twist of his head,
Soon gave me to know I had nothing to dread;
He spoke not a word, but went straight to his work,
And filled all the stockings; then turned with a jerk
And laying his finger aside of his nose,

And giving a nod, up the chimney he rose;
He sprang to his sleigh, to his team gave a whistle,
And away they all flew like the down of a thistle.
But I heard him exclaim, ere he drove out of sight,
"Happy Christmas to all, and to all a good-night."

Jest 'Fore Christmas

By EUGENE FIELD (1850-1895)

FATHER calls me William, sister calls me Will,
Mother calls me Willie, but the fellers call me Bill!
Mighty glad I ain't a girl—ruther be a boy,
Without them sashes, curls, an' things that's worn by Fauntleroy!
Love to chawnk green apples an' go swimmin' in the lake—
Hate to take the castor-ile they give for belly-ache!
'Most all the time, the whole year round, there ain't no flies on me,
But jest 'fore Christmas I'm as good as I kin be.

Got a yeller dog named Sport, sick him on the cat;
First thing she knows she doesn't know where she is at!
Got a clipper sled, an' when us kids goes out to slide,
'Long comes the grocery cart, an' we all hook a ride!
But sometimes when the grocery man is worrited an' cross,
He reaches at us with his whip, an' larrups up his hoss,
An' then I laff an' holler, "Oh, ye never teched *me!"*
But jest 'fore Christmas I'm as good as I kin be!

Gran'ma says she hopes that when I git to be a man,
I'll be a missionarer like her oldest brother Dan,
As was et up by the cannibuls that lives in Ceylon's Isle,
Where every prospeck pleases, an' only man is vile!
But gran'ma she has never been to see a Wild West show,
Nor read the Life of Daniel Boone, or else I guess she'd know
That Buff'lo Bill and cow-boys is good enough for me!
Excep' jest 'fore Christmas, when I'm good as I kin be!

And then old Sport he hangs around, so solemn-like an' still,
His eyes they keep a-sayin': "What's the matter, little Bill?"
The old cat sneaks down off her perch an' wonders what's become
Of them two enemies of hern that used to make things hum!
But I am so perlite an' 'tend so earnestly to biz,
That mother says to father: "How improved our Willie is!"
But father, havin' been a boy hisself, suspicions me
When jest 'fore Christmas, I'm as good as I kin be!

For Christmas, with its lots an' lots of candies, cakes an' toys,
Was made, they say, for proper kids an' not for naughty boys;
So wash yer face an' bresh yer hair, an' mind yer p's an' q's,
An' don't bust out yer pantaloons, an' don't wear out yer shoes;
Say "Yessum" to the ladies, an' "Yessur" to the men,
An' when they's company, don't pass yer plate for pie again;
But, thinking of the things yer'd like to see upon that tree,
Jest 'fore Christmas be as good as yer kin be!

Good King Wenceslas

By John Mason Neale (1818-1866)

Good King Wenceslas looked out
On the feast of Stephen,
When the snow lay round about,
Deep and crisp and even.
Brightly shone the moon that night,
Though the frost was cruel;
When a poor man came in sight,
Gathering winter fuel.

"Hither, page, and stand by me,
If thou know'st it telling—
Yonder peasant, who is he,
Where and what his dwelling?"
"Sire, he lives a good league hence,
Underneath the mountain,
Right against the forest fence
By Saint Agnes' fountain."

"Bring me flesh and bring me wine,
Bring me pine-logs hither;
Thou and I will see him dine,
When we bear them thither."
Page and monarch forth they went,
Forth they went together,
Through the rude wind's wild lament,
And the bitter weather.

"Sire, the night is darker now,
And the wind blows stronger;
Fails my heart I know not how—
I can go no longer."

"Mark my footsteps, good my page,
Tread thou in them boldly;
Thou shalt find the winter's rage
Freeze thy blood less coldly."

In his master's steps he trod,
Where the snow lay dinted.
Heat was in the very sod
Which the saint had printed.
Therefore, Christian men, be sure,
Wealth or rank possessing,
Ye who now will bless the poor
Shall yourselves find blessing.

While Shepherds Watched

By Nahum Tate (1652-1715)

While shepherds watched their flocks by night,
All seated on the ground,
The angel of the Lord came down,
And glory shone around.

"Fear not," said he, for mighty dread
Had seized their troubled mind;
"Glad tidings of great joy I bring
To you and all mankind.

"To you, in David's town, this day
Is born, of David's line,
The Saviour, who is Christ the Lord,
And this shall be the sign:

"The heavenly babe you there shall find
To human view displayed,
All meanly wrapped in swaddling bands,
And in a manger laid."

Thus spake the seraph; and forthwith
  Appeared a shining throng
Of angels praising God, who thus
  Addressed their joyful song:

"All glory be to God on high,
  And to the earth be peace;
Good will henceforth from Heaven to men
  Begin and never cease."

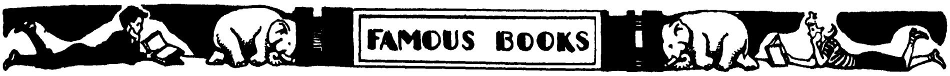
Old Christmas

By Sir Walter Scott (1771-1832)

Heap on more wood!—the wind is chill.
  But let it whistle as it will,
We'll keep our Christmas merry still.
Each age has deemed the new-born year
The fittest time for festal cheer;
And well our Christian sires of old
Loved when the year its course had roll'd
And brought blithe Christmas back again
With all its hospitable train.
Domestic and religious rite
Gave honor to the holy night;
On Christmas Eve the bells were rung;
On Christmas Eve the mass was sung:
That only night in all the year
Saw the stoled priest the chalice rear.
The damsel donn'd her kirtle sheen,
The hall was dress'd with holly green;
Forth to the wood did merry-men go,
To gather in the mistletoe.
Then open'd wide the baron's hall
To vassal, tenant, serf, and all;
Power laid his rod of rule aside,
And Ceremony doff'd his pride.
The heir, with roses in his shoes,
That night might village partner choose;
The lord, underogating, share
The vulgar game of "post and pair."
All hail'd with uncontroll'd delight
And general voice, the happy night,
That to the cottage, as the crown,
Brought tidings of Salvation down.
The fire, with well-dried logs supplied,
Went roaring up the chimney wide;
The huge hall-table's oaken face,
Scrubb'd till it shone, the day to grace,
Bore then upon its massive board
No mark to part the squire and lord;
Then was brought in the lusty brawn,
By old blue-coated serving-man;
Then the grim boar's head frown'd on high,
Crested with bays and rosemary.
Well can the green-garb'd ranger tell
How, when, and where, the monster fell;
What dogs before his death he tore,
And all the baiting of the boar.
The wassail round, in good brown bowls,
Garnish'd with ribbons, blithely trowls.
There the huge sirloin reek'd; hard by
Plum-porridge stood, and Christmas pie;
Nor fail'd old Scotland to produce,
At such high tides, her savory goose.
Then came the merry-makers in,
And carols roar'd with blithesome din;
If unmelodious was the song,
It was a hearty note, and strong.
Who lists may in their mumming see
Traces of ancient mystery;
White shirts supplied the masquerade,
And smutted cheeks the visors made;—
But, O! what maskers, richly dight,
Can boast of bosoms half so light!
England was merry England, when
Old Christmas brought his sports again.

THE NEXT POEMS ARE ON PAGE 6249.

WONDERFUL PARTY—WONDERFUL GAMES!



The Story of Old Scrooge

Adapted from A CHRISTMAS CAROL IN PROSE

By CHARLES DICKENS

MARLEY was dead. There is no doubt whatever about that. The register of his burial was signed by the clergyman, the clerk, the undertaker and the chief mourner. Scrooge signed it. And Scrooge's name was good upon 'Change for anything he chose to put his hand to.

Old Marley was dead as a door-nail.

Scrooge and he were partners for I don't know how many years. Scrooge was his sole executor, his sole administrator, his sole assign, his sole residuary legatee, his sole friend and sole mourner. . . .

Scrooge never painted out Old Marley's name. There it stood, years afterward, above the warehouse door: Scrooge and Marley. Sometimes people new to the business called Scrooge Scrooge, and sometimes Marley, but he answered to both names. It was all the same to him.

Oh! But he was a tight-fisted hand at the grindstone. Scrooge! a squeezing, wrenching, grasping, scraping, clutching, covetous old sinner! Secret and self-contained and solitary as an oyster. . . .

Once upon a time—of all the good days in the year, on Christmas Eve—old Scrooge sat busy in his counting-house. It was cold, bleak, biting weather: foggy withal: and he could hear the people in the court outside go wheezing up and down, beating their hands upon their breasts, and stamping their feet upon the pavement stones to warm them.

The door of Scrooge's counting-house was open that he might keep his eye upon his clerk who, in a dismal little cell beyond, a sort of tank, was copying letters.

Scrooge had a very small fire, but the clerk's fire was so very much smaller that it looked like one coal. But he couldn't replenish it, for Scrooge kept the coal-box in his own room; and so surely as the clerk came in with the shovel, the master predicted that it would be necessary for them to part. Wherefore the clerk put on his white comforter, and tried to warm himself at the candle; in which effort, not being a man of strong imagination, he failed.

"A Merry Christmas, uncle! God save you!" cried a cheerful voice. It was the voice of Scrooge's nephew, who came upon him so quickly that this was the first intimation he had of his approach.

"Bah!" said Scrooge. "Humbug!"

He had so heated himself with rapid walking in the fog and frost, this nephew of Scrooge's, that he was all in a glow; his face was ruddy and handsome; his eyes sparkled, and his breath smoked.

"Christmas a humbug, uncle!" said Scrooge's nephew. "You don't mean that, I'm sure."

"I do," said Scrooge. "Merry Christmas! What right have you to be merry? What reason have you to be merry? You're poor enough!"

"Come, then," returned the nephew gaily; "what right have you to be dismal? What reason have you to be morose? You're rich enough!"

Scrooge, having no better answer ready on the spur of the moment, said "Bah!" again.

"Don't be cross, uncle!" said the nephew.

"What else can I be," returned the uncle, "when I live in such a world of fools as this? Merry Christmas! Out upon merry Christmas! What's Christmas time to you but a time for paying bills without money; a time for finding yourself a year older, but not an hour richer? Bah! Keep Christmas in your own way, and let me keep it in mine!"

"Keep it!" repeated Scrooge's nephew. "But you don't keep it!"

"Let me leave it alone, then," said Scrooge. And so he went on, denouncing Christmas in a frightful way, and refusing utterly to say a good word about it or anybody or anything, until his good-natured nephew went away. Scrooge resumed his labors with an improved opinion of himself.

Meanwhile the fog and darkness thickened, so that people ran about with flaring links, proffering their services to go before horses in carriages and conduct them on their way.

The ancient tower of a church, whose gruff old bell was always peeping slyly down at Scrooge out of a gothic window in the wall, became invisible, and struck the hours and quarters in the clouds, with tremulous vibrations afterwards, as if its teeth were chattering in its frozen head up there. The cold became intense. In the main street, at the corner of the court, some laborers were repairing the gaspipes, and had lighted a great fire in a brazier, round which a party of ragged men and boys were gathered warming their hands and winking their eyes before the blaze.

The brightness of the shops, where holly sprigs and berries crackled in the lamp heat of the windows, made pale faces ruddy as they passed. Poulterers' and grocers' trades became a splendid joke — a glorious pageant, with which it was next to impossible to believe that such dull principles as bargain and sale had anything to do. The Lord Mayor, in the stronghold of the mighty Mansion House, gave orders to his fifty cooks and butlers to keep Christmas as a Lord Mayor's household should; and even the little tailor, whom he had fined five shillings on the previous Monday for being drunk and bloodthirsty in the streets, stirred up to-morrow's pudding in his garret while his lean wife and the baby sallied out to buy the beef.

His dressing-gown, in a suspicious attitude.

Not a knocker, but Marley's face.

Foggier yet, and colder! At length the hour of shutting up the counting-house arrived. With an ill-will Scrooge dismounted from his stool, and tacitly admitted the fact to the expectant clerk in the tank, who instantly snuffed his candle out, and put on his hat.

"You'll want all day to-morrow, I suppose?" said Scrooge.

"If quite convenient, sir."

"It's not convenient," said Scrooge, "and it's not fair. If I was to stop half-a-crown for it, you'd think yourself ill-used, I'll be bound? And yet," said Scrooge, "you don't think *me* ill-used, when I pay a day's wages for no work."

The clerk observed that it was only once a year.

"A poor excuse for picking a man's pocket every twenty-fifth of December!" said Scrooge, buttoning his greatcoat to the chin. "But I suppose you must have the whole day. Be here all the earlier next morning."

The clerk promised that he would; and Scrooge walked out with a growl. The office was closed in a twinkling, and the clerk, with the long ends of his white comforter dangling below his waist (for he boasted no greatcoat), went down a slide on Cornhill, at the end of a lane of boys, twenty times, in honor of its being Christmas Eve, and then ran home to Camden Town as hard as he could pelt.

Scrooge took his melancholy dinner in his usual melancholy tavern; and having read all the newspapers, went home to bed. He lived in chambers which had once belonged to his deceased partner. They were a gloomy suite of rooms, in a lowering pile of building up a yard. It was old enough now, and dreary enough, for nobody lived in it but Scrooge, the other rooms being all let out as offices. The yard was so dark that even Scrooge, who knew its every stone, was fain to grope with his hands. The fog and frost so hung about the black old gateway of the house, that it seemed as if the genius of the weather sat in mournful meditation on the threshold.

Now, it is a fact that there was nothing particular about the knocker on the door, except that it was very large. And then let any man explain to me, if he can, how it happened that Scrooge, having his key in the lock of the door, saw in the knocker, without its undergoing any intermediate process of change—not a knocker, but Marley's face.

Marley's face. It was not in impenetrable shadow as the other objects in the yard were, but had a dismal light about it, like a bad lobster in a dark cellar. It was not angry or ferocious, but looked at Scrooge as Marley used to look, with ghostly spectacles turned up on his ghostly forehead. The hair was curiously stirred, as if by breath or hot air; and, though the eyes were wide open, they were perfectly motionless.

As Scrooge looked fixedly at this phenomenon, it was a knocker again.

To say that he was not startled, or that his blood was not conscious of a terrible sensation to which it had been a stranger from infancy, would be untrue. But he put his hand upon the key he had relinquished, turned it sturdily, walked in, and lighted his candle.

He *did* pause, with a moment's irresolution, before he shut the door; and he *did* look cautiously behind it first, as if he half expected to be terrified with the sight of Marley's pigtail sticking out into the hall. But there was nothing on the back of the door, except the screws and nuts that held the knocker on, so he said, "Pooh, pooh!" and closed it with a bang.

The sound resounded through the house like thunder. Every room above, and every cask in the wine-merchant's cellars below, appeared to have a separate peal of echoes of its own. Scrooge was not a man to be frightened by echoes. He fastened the door and walked across the hall, and up the stairs; slowly, too; trimming his candle as he went.

Up Scrooge went. The old staircase was wide, and the faint, flickering light of the candle hardly dispelled the gloom. Before Scrooge shut his heavy door, he walked through his rooms to see that all was right. He had just enough recollection of the face to desire to do that.

Sitting-room, bedroom, lumber-room. All as they should be. Nobody under the table, nobody under the sofa; a small fire in the grate, spoon and basin ready, and the little saucepan of gruel upon the hob, for Scrooge had a cold in his head. Nobody under the bed; nobody in the closet; nobody in his dressing-gown, which was hanging up in a suspicious attitude against the wall. Lumber-room as usual—old fire-guard, old shoes, two fish-baskets, washing-stand on three legs, and a poker.

Quite satisfied, he closed the door, and locked himself in — double-locked himself in, which was not his custom. Thus secured against surprise, he took off his cravat, put on his dressing-gown and slippers, and his nightcap, and sat down before the fire to take his gruel.

He was the Ghost of Christmas Past.

Presently his glance happened to rest upon a bell, a disused bell, that hung in the room, and communicated, for some purpose now forgotten, with a chamber in the highest story of the building. It was with great astonishment, and with a strange inexplicable dread, that as he looked he saw this bell begin to swing. It swung so softly in the outset that it scarcely made a sound; but soon it rang out loudly, and so did every bell in the house.

This might have lasted half a minute, or a minute, but it seemed an hour. The bells ceased as they had begun, together. They were succeeded by a clanking noise, deep down below; as if some person were dragging a heavy chain over the casks in the wine merchant's cellar. Scrooge then remembered to have heard that ghosts in haunted houses were described as dragging chains.

The cellar door flew open with a booming sound, and then he heard the noise much louder, on the floors below; then coming up the stairs; then coming straight towards his door.

"It's humbug still!" said Scrooge. "I won't believe it."

His color changed, though, when, without a pause, it came on through the heavy door, and passed into the room before his eyes. Upon its coming in, the dying flame leaped up, as though it cried, "I know him! Marley's ghost!" and fell again.

The same face: the very same. Marley in his pigtail, usual waistcoat, tights, and boots; the tassels on the latter bristling, like his pigtail, and his coat-skirts, and the hair upon his head. The chain he drew was clasped about his middle. It was long, and wound about him like a tail; and it was made (for Scrooge observed it closely) of cash-boxes, keys, padlocks, ledgers, deeds, and heavy purses wrought in steel. His body was transparent; so that Scrooge, observing him, and looking through his waistcoat, could see the two buttons on his coat behind.

When Scrooge summoned up courage to speak to the ghost it told him that the chain was all the misdeeds and unkind actions of which he had been guilty, and that Scrooge himself was making a chain which would be an awful weight to him when he was dead. The ghost also told him that he would be visited by three spirits, the first coming at one o'clock in the morning; and if he valued his future peace he had better see what the spirits would show him. Then old Marley's ghost vanished. Scrooge looked out of his window and saw many such phantoms, with heavy chains about their waists, like that which had burdened Marley.

Old Fezziwig laid down his pen.

Scrooge closed the window, and examined the door by which the ghost had entered. It was double-locked, as he had locked it with his own hands, and the bolts were undisturbed. He tried to say "Humbug!" but stopped at the first syllable. And being, from the emotion he had undergone, or the fatigues of the day, or his glimpse of the invisible world, or the dull conversation of the ghost, or the lateness of the hour, much in need of repose, went straight to bed, without undressing, and fell asleep upon the instant.

II

When he awoke it was still dark, and he had no idea of the time. But while he lay on the bed, peering anxiously into the gloom, the curtains were drawn aside by a hand, and the first of the promised spirit-visitors stood before him.

It was a strange figure—like a child; yet not so like a child as like an old man, viewed through some supernatural medium, which gave him the appearance of having receded from the view, and being diminished to a child's proportions. Its hair, which hung about its neck and down its back, was white, as if with age; and yet the face had not a wrinkle in it and the tenderest bloom was on the skin. The arms were very long and muscular; the hands the same, as if its hold were of uncommon strength. Its legs and feet, most delicately formed, were like those upper members, bare. It wore a tunic of the purest white, and round its waist was bound a lustrous belt, the sheen of which was beautiful. It held a branch of fresh green holly in its hand, and, in a singular contradiction of that wintry emblem, had its dress trimmed with summer flowers. But the strangest thing about it was that from the crown of its head there sprang a bright, clear jet of light, by which all this was visible; and which was doubtless the occasion of its using, in its duller moments, a great extinguisher for a cap, which it now held under its arm.

He told the miserly old man that he was the Ghost of Christmas Past, and before Scrooge knew it he found himself away many miles, led by the spirit, and back many weary years, seeing his own boyhood's home, as well as many happy scenes he had long forgotten, but was delighted to see again. He was shown some Christmases of long ago, when he was a child. Some of them were sad, for he was a lonely boy; some were jolly. Best of all, the spirit took him to the warehouse where he had been an apprentice. When they peeped in Scrooge cried out, on seeing an old gentleman in a Welsh wig, sitting at a high desk; "Why, it's old Fezziwig! Bless his heart, it's Fezziwig alive again!"

Old Fezziwig laid down his pen, and looked up at the clock, which pointed to the hour of seven. He rubbed his hands, adjusted his capacious waistcoat, laughed all over himself, from his shoes to his organ of benevolence, and called out in a comfortable, oily, rich, fat, jovial voice: "Yo, ho, there! Ebenezer! Dick!" Scrooge's former self, now grown a young man, came briskly in, accompanied by his fellow-'prentice.

"Dick Wilkins, to be sure!" said Scrooge to the ghost. "Bless me, yes. There he is. He was very much attached to me, was Dick. Poor Dick! Dear, dear!"

"Yo ho, my boys!" said Fezziwig. "No more work tonight. Christmas Eve, Dick! Christmas, Ebenezer! Let's have the shutters up," cried old Fezziwig, with a sharp clap of his hands, "before a man can say Jack Robinson!"

You wouldn't believe how those two fellows went at it. They charged into the street with the shutters (one, two, three), had 'em barred up in their places (four, five, six), pinned 'em (seven, eight, nine), and came back before you could have got to twelve, panting like a race horse.

In came Mrs. Fezziwig, and the three Miss Fezziwigs.

The fiddler instantly began again.

"Hilli-ho!" cried Fezziwig, skipping down from the high desk with wonderful agility. "Clear away, my lads, and let's have lots of room here! Hilli-ho, Dick! Chirrup, Ebenezer!"

Clear away! There was nothing that they wouldn't have cleared away, or couldn't have cleared away, with old Fezziwig looking on. It was done in a minute. Every movable was packed off, as if it were dismissed from public life for evermore. The floor was swept and watered, the lamps were trimmed, fuel was heaped upon the fire, and the warehouse was as snug and warm and dry and bright a ballroom as you would ever desire to see upon a cold winter's night.

In came a fiddler with a music-book, and went up to the lofty desk and made an orchestra of it, and tuned like fifty stomach-aches. In came Mrs. Fezziwig, one vast substantial smile. In came the three Miss Fezziwigs, beaming and lovable. In came the six young followers whose hearts they broke. In came all the young men and women employed in the business. In came the housemaid, with her cousin, the baker. In came the cook, with her brother's particular friend, the milkman. In came the boy from over the way, who was suspected of not having board enough from his master, trying to hide himself behind the girl from next door but one, who was proved to have had her ears pulled by her mistress. In they all came, one after another—some shyly, some boldly, some gracefully, some awkwardly, some pushing, some pulling. In they all came, anyhow and everyhow.

Away they all went, twenty couples at once; hands half round and back again the other way; down the middle and up again; round and round in various stages of affectionate grouping; old top couples always turning up in the wrong places, new top couple starting off again as soon as they got there; all top couples at last, and not a bottom one to help them. When this result was brought about, old Fezziwig, clapping his hands to stop the dance, cried out "Well done!" and the fiddler plunged his hot face into a pot of porter, especially provided for that purpose. But, scorning rest, upon his reappearance he instantly began again, though there were no dancers yet, as if the other fiddler had been carried home, exhausted, on a shutter, and he were a brand-new man resolved to beat him out of sight, or perish.

When the clock struck eleven, this domestic ball broke up. Mr. and Mrs. Fezziwig took their stations, one on either side of the door, and shaking hands with every person individually, as he or she went out, wished him or her A Merry Christmas. When everybody had

Down the middle and up again—round and round!

retired but the two 'prentices, they did the same to them; and thus the cheerful voices died away, and the lads were left to their beds; which were under a counter in the back shop.

During the whole of this time, Scrooge had acted like a man out of his wits. His heart and soul were in the scene, and with his former self. He corroborated everything, and underwent the strangest agitation. It was not until now, when the bright faces of his former self and Dick were turned from them, that he remembered the ghost, and became conscious that it was looking full upon him, while the light upon its head burned very clear.

Other scenes of his past life Old Scrooge re-lived by the light of Christmas Past, till the old curmudgeon could bear no more. He turned upon the ghost, and seeing that it looked upon him with a face in which in some strange way there were fragments of all the faces it had shown him, wrestled with it.

"Leave me! Take me back. Haunt me no longer!"

In the struggle, if that can be called a struggle in which the ghost with no visible resistance on its own part was undisturbed by any effort of its adversary, Scrooge observed that its light was burning high and bright; and dimly connecting that with its influence over him, he seized the extinguisher-cap, and by a sudden action pressed it down upon its head.

The spirit dropped beneath it, so that the extinguisher covered its whole form; but though Scrooge pressed it down with all his force, he could not hide the light, which streamed from under it in an unbroken flood upon the ground.

He was conscious of being exhausted, and overcome by an irresistible drowsiness; and, further, of being in his own bedroom. He gave the cap a parting squeeze, in which his hand relaxed; and had barely time to reel to bed, before he sank into a heavy sleep.

III

Awaking in the middle of a prodigiously tough snore, Scrooge had no occasion to be told that the bell was again upon the stroke of one. Now, being prepared for almost anything, he was not by any means prepared for nothing; and, consequently, when the bell struck one, and no shape appeared, he was taken with a violent fit of trembling. Five minutes, ten minutes, a quarter of an hour went by, yet nothing came. All this time, he lay upon his bed, the very core and center of a blaze of ruddy light, which streamed upon it when the clock proclaimed the hour; and which, being only light, was more alarming than a dozen ghosts, as he was powerless to make out what it meant, or would be at. At last, however, he began to think—as you or I would have thought at first, that the source and secret of this ghostly light might be in the adjoining room. This idea taking full possession of his mind, he got up softly and shuffled in his slippers to the door.

The moment Scrooge's hand was on the lock a strange voice called him by his name, and bade him enter. He obeyed. It was his own room. There was no doubt about that. But it had undergone a surprising transformation. The walls and ceiling were so hung with living green that it looked a perfect grove, from every part of which bright, gleaming berries glistened.

The crisp leaves of holly, mistletoe, and ivy reflected back the light, as if so many little mirrors had been scattered there; and such a mighty blaze went roaring up the chimney as that dull hearth had never known in Scrooge's day or in Marley's. Heaped up on the floor, to form a kind of throne, were turkeys, geese, game, poultry, brawn, great joints of meat, sucking-pigs, long wreaths of sausages, mince-pies, plum-puddings, barrels of oysters, red-hot chestnuts, cherry-cheeked apples, juicy oranges, and seething bowls of punch, that made the chamber dim with their delicious steam. In easy state upon this couch there sat a jolly giant, glorious to see, who bore a glowing torch, in shape not unlike Plenty's horn, and held it up, high up, to shed its light on Scrooge, as he came peeping round the door.

"Come in!" exclaimed the ghost. "Come in and know me better, man!"

Scrooge entered timidly, and hung his head before this spirit. He was not the dogged Scrooge he had been, and though the spirit's eyes were clear and kind, he did not like to meet them.

"I am the Ghost of Christmas Present," said the spirit. "Look upon me!"

Holly, mistletoe, red berries, ivy, turkeys, geese, game, poultry, brawn, meat, pigs, sausages, oysters, pies, puddings, fruit, and punch, all vanished instantly. So did the room, the fire, the ruddy glow, the hour of night, and they stood in the city streets on Christmas morning, where (for the weather was severe) the people made a rough, but brisk and not unpleasant, kind of music, in scraping the snow from the pavement in front of their dwellings.

The people who were shovelling away were jovial and full of glee; calling out to one another, and now and then exchanging a facetious snow-ball, laughing heartily if it went wrong. The poulterers' shops were still half open, and the fruiterers' were radiant in their glory. There were great, round, pot-bellied baskets of chestnuts, shaped like the waistcoats of jolly old gentlemen, lolling at the doors, and tumbling out into the street in their apoplectic opulence. There were ruddy, brown-faced, broad-girthed Spanish onions. There were pears and apples, clustered high in blooming pyramids; there were bunches of grapes; there were piles of filberts, mossy and brown, recalling, in their fragrance, ancient walks among the woods and pleasant shufflings ankle-deep through withered leaves; there were Norfolk biffins, squat and swarthy, setting off the yellow of the oranges and lemons, and, in the great compactness of their juicy persons, urgently entreating and beseeching to be carried home in paper-bags and eaten after dinner. The very gold and silver fish, set forth among these choice fruits in a bowl, appeared to know that there was something going on; and, to a fish, went gasping round and round their little world in slow and passionless excitement.

The Ghost of Christmas Present.

The grocers'! oh, the grocers'! nearly closed, with perhaps two shutters down, or one; but through those gaps such glimpses! It was not alone that the scales descending on the counter made a merry sound, or that the twine and roller parted company so briskly, or that the canisters were rattled up and down like juggling tricks, or even that the blended scents of tea and coffee were so grateful to the nose, or even that the raisins were so plentiful and rare, the almonds so extremely white, the sticks of cinnamon so long and straight, the other spices so delicious, the candied fruits so caked and spotted with molten sugar as to make the coldest lookers-on feel faint. Nor was it that the figs were moist and pulpy, or that the French plums blushed in modest tartness from their highly decorated boxes, or that everything was good to eat and in its Christmas dress. But the customers were all so hurried and so eager in the hopeful promise of the day, that they tumbled up against each other at the door, crashing their wicker baskets wildly, and left their purchases upon the counter, and came running back to fetch them and committed hundreds of the like mistakes, in the best humor possible; while the grocer and his people were so frank and fresh that the polished hearts with which they fastened their aprons behind might have been their own, worn outside for general inspection!

But soon the steeples called good people all to church and chapel, and away they came, flocking through the streets in their best clothes, and with their gayest faces. And at the same time there emerged from scores of by-streets, lanes, and nameless turnings, innumerable people, carrying their dinners to the bakers' shops. In time the bells ceased, and the bakers' were shut up; and yet there was a genial shadowing forth of all these dinners and the progress of their cooking, in the thawed blotch of wet above each baker's oven; where the pavement smoked as if its stones were cooking too.

Scrooge and the Spirit went on, invisible, as they had been before, into the suburbs of the town. It was a remarkable quality of the ghost that, notwithstanding his gigantic size, he could accommodate himself to any place with ease; and that he stood beneath a low roof quite as gracefully as it was possible he could have done in any lofty hall.

And perhaps it was the pleasure the good spirit had in showing off this power of his, or else it was his own kind, generous, hearty nature, and his sympathy with all poor men, that led him straight to Scrooge's clerk's; for there he went, and took Scrooge with him, holding to his robe: and on the threshold of the door the Spirit smiled, and stopped to bless Bob Cratchit's dwelling with the sprinklings of his torch. Think of that! Bob had but fifteen "Bob" a week himself; he pocketed on Saturdays but fifteen copies of his Christian name; and yet the Ghost of Christmas Present blessed his four-roomed house!

Then up rose Mrs. Cratchit, Cratchit's wife, dressed out but poorly in a twice-turned gown, but brave in ribbons, which are cheap and make a goodly show for sixpence; and she laid the cloth, assisted by Belinda Cratchit, second of her daughters, also brave in ribbons; while Master Peter Cratchit plunged a fork into the saucepan of potatoes, and getting the corners of his monstrous shirt-collar (Bob's private property conferred upon his son and heir in honor of the day) into his mouth, rejoiced to find himself so gallantly attired. And now two smaller Cratchits, boy and girl, came tearing in, screaming that outside the baker's they had smelled the goose, and known it for their own; and basking in luxurious thoughts of sage and onion, these young Cratchits danced about the table, and exalted Master Peter Cratchit to the skies, while he (not proud, although his collars nearly choked him) blew the fire, until the slow potatoes bubbling up, knocked loudly at the saucepan-lid to be let out and peeled.

"What has ever got your precious father then?" said Mrs. Cratchit. "And your brother, Tiny Tim! And Martha warn't as late last Christmas Day by half an hour."

"Here's Martha, mother!" said a girl, appearing as she spoke.

"Here's Martha, mother!" cried the two young Cratchits. "Hurrah! There's *such* a goose, Martha!"

"Why, bless your heart alive, my dear, how late you are!" said Mrs. Cratchit, kissing her a dozen times, and taking off her shawl and bonnet for her.

"We'd a deal of work to finish up last night," replied the girl, "and had to clear away this morning, mother!"

"Well! Never mind so long as you are come," said Mrs. Cratchit. "Sit ye down before the fire, my dear."

"No, no! There's father coming," cried the two young Cratchits, who were everywhere at once. "Hide, Martha, hide!"

So Martha hid herself, and in came Bob, the father, with at least three feet of comforter exclusive of the fringe hanging down before him; and his threadbare clothes darned up and brushed to look seasonable; and Tiny Tim upon his shoulder. Alas for Tiny Tim, he bore a little crutch, and had his limbs supported by an iron frame!

"Why, where's our Martha?" cried Bob Cratchit, looking round.

"Not coming," said Mrs. Cratchit.

"Not coming!" said Bob, with a sudden declension in his high spirits; for he had been Tim's blood-horse all the way from church, and had come home rampant. "Not coming upon Christmas Day!"

Martha didn't like to see him disappointed, if it were only in joke; so she came out prematurely from behind the closet door, and ran into his arms, while the two young Cratchits hustled Tiny Tim, and bore him off into the wash-house, that he might hear the pudding singing in the copper.

"And how did little Tim behave?" asked Mrs. Cratchit, when she had rallied Bob on his credulity, and Bob had hugged his daughter to his heart's content.

"As good as gold," said Bob, "and better. Somehow he gets thoughtful, sitting by himself so much, and thinks the strangest things you ever heard. He told me, coming home, that he hoped the people saw him in the church, because he was a cripple, and it might be pleasant to them to remember upon Christmast Day who made lame beggars walk and blind men see."

Bob's voice was tremulous when he told them this, and trembled more when he said that Tiny Tim was growing strong and hearty.

His active little crutch was heard upon the floor, and back came Tiny Tim before another word was spoken, escorted by his brother and sister to his stool beside the fire; and while Bob, turning up his cuffs—as if, poor fellow, they were capable of being made more shabby—compounded some hot mixture in a jug, and stirred it round and round, and put it on the hob to simmer; Master Peter and the two ubiquitous young Cratchits went to fetch the goose, with which they soon returned in high procession.

Such a bustle ensued that you might have thought a goose the rarest of all birds—and in truth it was something very like it in that house. Mrs. Cratchit made the gravy (ready beforehand in a little saucepan) hissing hot; Master Peter mashed the potatoes with incredible vigor; Miss Belinda sweetened up the applesauce; Martha dusted the hot plates; Bob took Tiny Tim beside him in a tiny corner at the table; the two young Cratchits set chairs for everybody, not forgetting themselves. At last the dishes were set on, and grace was said. It was succeeded by a breathless pause, as Mrs. Cratchit, looking slowly all along the carving knife, prepared to plunge it in the breast; but when she did, and when the long-expected gush of stuffing issued forth, one murmur of delight arose all round the board, and even Tiny Tim, excited by the young Cratchits, beat on the table with the handle of his knife, and feebly cried Hurrah!

Mrs. Cratchit—flushed but smiling—with the pudding.

There never was such a goose. Bob said he didn't believe there ever was such a goose cooked. Its tenderness and flavor, size and cheapness, were the themes of universal admiration. Eked out by applesauce and mashed potatoes, it was a sufficient dinner for the whole family. Every one had had enough, and the youngest Cratchits were steeped in sage and onion to the eyebrows! But now, the plates being changed by Miss Belinda, Mrs. Cratchit left the room alone — too nervous to bear witnesses — to take the pudding up, and bring it in.

Suppose it should not be done enough! Suppose it should break in turning out! Suppose somebody should have got over the wall of the back-yard, and stolen it, while they were merry with the goose!

Hollo! A great deal of steam! The pudding was out of the copper. A smell like a washing-day! That was the cloth. A smell like an eating-house and a pastrycook's next door to each other. That was the pudding! In half a minute Mrs. Cratchit entered—flushed, but smiling proudly — with the pudding, like a speckled cannon-ball, so hard and firm, blazing in half of half a quartern of ignited brandy, and bedight with Christmas holly stuck into the top.

Oh, a wonderful pudding! Bob Cratchit said, and calmly, too, that he regarded it as the greatest success achieved by Mrs. Cratchit since their marriage. Mrs. Cratchit said that now the weight was off her mind, she would confess that she had had her doubts about the quantity of flour. Everybody had something to say about it, but nobody said or thought it was at all a small pudding for a large family. Any Cratchit would have blushed to hint at such a thing.

At last the dinner was all done, the cloth was cleared, the hearth swept, and the fire made up. The compound in the jug being tasted, and considered perfect, apples and orange were put upon the table, and a shovelful of chestnuts on the fire. Then all the Cratchit family drew round the hearth, and at Bob Cratchit's elbow stood the family display of glass. Two tumblers, and a custard-cup without a handle.

These held the hot stuff from the jug, however, as well as golden goblets would have done; and Bob served it out with beaming looks, while the chestnuts on the fire sputtered and cracked noisily. Then Bob proposed—

"A Merry Christmas to us all, my dears. God bless us!" Which all the family re-echoed.

"God bless us every one!" said Tiny Tim, the last of all. He sat very close to his father's side, upon his little stool. Bob held his withered little hand in his, as if he loved the child, and wished to keep him by his side, and dreaded that he might be taken from him.

"Spirit," said Scrooge, with an interest he had never felt before, "tell me if Tiny Tim will live."

"I see a vacant seat," replied the ghost, "in the poor chimney-corner, and a crutch without an owner, carefully preserved. If these shadows remain unaltered by the future none other of my race," returned the ghost, "will find him here. What then? If he be like to die, he had better do it, and decrease the surplus population."

Scrooge hung his head to hear his own words quoted by the spirit, and was overcome with penitence and grief. But he raised his eyes speedily, on hearing his own name.

"Mr. Scrooge!" said Bob, "I'll give you Mr. Scrooge, the founder of the feast!"

"The founder of the feast indeed!" cried Mrs. Cratchit, reddening. "I wish I had him here. I'd give him a piece of my mind to feast upon, and I hope he'd have a good appetite for it."

"My dear," was Bob's mild answer, "the children! Christmas Day."

"It should be Christmas Day, I am sure," said she, "on which one drinks the health of such an odious, stingy, hard, unfeeling man as Mr. Scrooge. You know he is, Robert! Nobody knows it better than you do, poor fellow!"

"My dear," was Bob's mild answer again, "Christmas Day."

"I'll drink his health for your sake and the day's," said Mrs. Cratchit, "not for his. Long life to him! A Merry Christmas and a Happy New Year! He'll be very merry and very happy, I have no doubt!"

The children drank the toast after her. It was the first of their proceedings which had no heartiness in it. Tiny Tim drank it last of all, but he didn't care twopence for it. Scrooge was the ogre of the family. The mention of his name cast a dark shadow on the party, which was not dispelled for full five minutes.

Next the spirit whirled Scrooge on through a colliery village, where poor folk were rejoicing around Christmas fires; to a lighthouse in the stormy sea, where lonely men still wished each other a happy Christmas; to the home of his nephew, Fred, where everything was happiness, and even his own name was spoken not with contempt, but with sorrow and sympathy, because he was not enjoying the season of good-will.

To many other homes and places the Ghost of Christmas Present took him, showing him misery and want as well as happiness and plenty. But as the bells struck twelve the spirit vanished, and a new and different figure came to him. This was the third and last of his strange, ghostly visitors.

IV

"I am in the presence of the Ghost of Christmas Yet to Come?" said Scrooge. The spirit answered not, but pointed onward with its hand. "You are about to show me shadows of the things that have not happened, but will happen in the time before us." Scrooge pursued. "Is that so, Spirit?" The upper portion of the garment was contracted for an instant in its folds, as if the spirit had inclined its head. That was the only answer he received.

The mission of this spirit was soon begun, for it showed him his own death and how not a soul was there to mourn his loss; how his death was rather a cause of happiness in some quarters than a sense of loss; but it also showed him how Tiny Tim might die and leave many friends to sorrow for him, because they had loved him, while his memory would endure in their hearts.......

"Spirit!" cried Scrooge, tight clutching at its robe, "hear me! I am not the man I was. I will not be the man I must have been but for this intercourse. Why show me all this, if I am past hope?"

For the first time the hand appeared to shake.

"Good spirit," he pursued, as down upon the ground he fell before it, "your nature intercedes for me, and pities me. Assure me that I yet may change these shadows you have shown me, by an altered life!"

The kind hand trembled.

"I will honor Christmas in my heart, and try to keep it all the year. I will live in the past, the present, and the future. The spirits of all three shall strive within me. I will not shut out the lessons that they teach. Oh, tell me I may sponge away the writing on this stone!"

In his agony, he caught the spectral hand. It sought to free itself, but he was strong in his entreaty, and detained it. The spirit, stronger yet, repulsed him.

Holding up his hands in a last prayer to have his fate reversed, he saw an alteration in the phantom's hood and dress. It shrank, collapsed, and dwindled down into a bedpost.

V

YES! and the bedpost was his own. The bed was his own, the room was his own. Best and happiest of all, the time before him was his own, to make amends in!

"I will live in the past, the present, and the future!" Scrooge repeated, as he scrambled out of bed. "The spirits of all three shall strive within me. O Jacob Marley! Heaven, and the Christmas time be praised for this! I say it on my knees, old Jacob; on my knees!"

He was checked in his transports by the churches ringing out the lustiest peals he had ever heard. Clash, clang, hammer; ding, dong, bell. Bell, dong, ding; hammer, clang, clash! Oh, glorious, glorious!

He dressed himself "all in his best," and at last got out into the streets. The people were by this time pouring forth, as he had seen them with the Ghost of Christmas Present; and walking with his hands behind him, Scrooge regarded every one with a delightful smile. He looked so irresistably pleasant, in a word, that three or four good-humoured fellows said, "Good-morning, sir. A Merry Christmas to you!" And Scrooge said often afterwards, that of all the blithe sounds he had ever heard, those were the blithest in his ears.

He had not gone far, when coming on towards him he beheld the portly gentleman

"God bless us every one!" said Tiny Tim.

who had walked into his counting-house the day before and asked him to give to a fund for the poor. It sent a pang across his heart to think how this old gentleman would look upon him when they met; but he knew what path lay straight before him and he took it.

"My dear sir," said Scrooge, quickening his pace, and taking the old gentleman by both his hands. "How do you do? I hope you succeeded yesterday. It was very kind of you. A Merry Christmas to you, sir! Allow me to ask your pardon. And will you have the goodness — — — " here Scrooge whispered in his ear.

"Lord bless me!" cried the gentleman, as if his breath were taken away. "My dear Mr. Scrooge, are you serious?"

"If you please," said Scrooge. "Not a farthing less. A great many back-payments are included in it. Bless you! Bless you!"

He went to church, and walked about the streets, and watched the people hurrying to and fro, and patted children on the head, and questioned beggars, and looked down into the kitchens of houses, and up to the windows; and found that everything could yield him pleasure. He had never dreamed that any walk—that anything—could give him so much happiness. In the afternoon, he turned his steps towards his nephew's house.

He passed the door a dozen times, before he had the courage to go up and knock. But he made a dash, and did it.

"Is your master at home, my dear?" said Scrooge to the girl. Nice girl! Very.

"Yes, sir."

"Where is he, my love?" said Scrooge.

"He's in the dining-room, sir, along with mistress. I'll show you upstairs, if you please."

"Thank'ee. He knows me," said Scrooge, with his hand already on the dining-room lock. "I'll go in here, my dear."

He turned it gently, and sidled his face in, round the door. They were looking at the table (which was spread out in great array); for these young housekeepers are always nervous on such points, and like to see that everything is right.

"Fred!" said Scrooge.

Dear heart alive, how his niece by marriage started!

"Why, bless my soul!" cried Fred, "who's that?"

"It's I. Your uncle Scrooge. I have come to dinner. Will you let me in, Fred?"

Let him in! It is a mercy he didn't shake his arm off. He was at home in five minutes. Nothing could be heartier. His niece looked just the same as she had in his vision of Christmas Present. So did everyone when they came. Wonderful party, wonderful games, wonderful unanimity, won-der-ful happiness.

"Tell me I may sponge away the writing!"

But he was early at the office next morning. Oh, he was early there. If he could only be there first, and catch Bob Cratchit coming late! That was the thing he had set his heart upon.

And he did it; yes, he did! The clock struck nine. No Bob. A quarter past. No Bob. He was a full eighteen minutes and a half behind his time. Scrooge sat with his door wide open, that he might see him come into the tank.

His hat was off before he opened the door; his comforter, too. He was on his stool in a jiffy; driving away with his pen, as if he were trying to overtake nine o'clock.

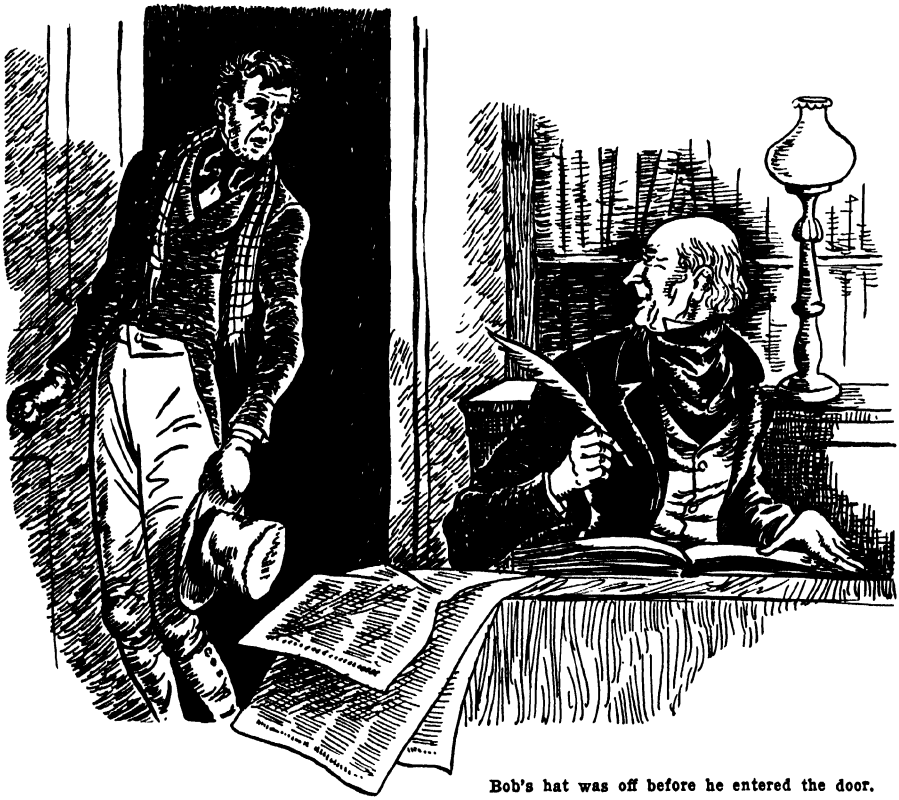
"Hollo!" growled Scrooge, in his accustomed voice, as near as he could feign it. "What do you mean by coming here at this time of day?"

"I am very sorry, sir," said Bob. "I *am* behind my time."

"You are?" repeated Scrooge. "Yes. I think you are. Step this way, sir, if you please."

"It's only once a year, sir," pleaded Bob, appearing from the tank. "It shall not be repeated. I was making rather merry yesterday, sir."

"Now, I'll tell you what, my friend," said Scrooge; "I am not going to stand this sort of thing any longer. And therefore," he continued, leaping from his stool, and giving Bob such a dig in the waistcoat that he staggered back into the tank again—"and therefore I am about to raise your salary!"



Bob's hat was off before he entered the door.

Bob trembled, and got a little nearer to the ruler. He had a momentary idea of knocking Scrooge down with it, holding him, and calling to the people in the court for help and a strait waistcoat.

"A Merry Christmas, Bob!" said Scrooge, with an earnestness that could not be mistaken, as he clapped him on the back. "A Merry Christmas—a merrier Christmas, Bob, my good fellow, than I have given you for many a year. I'll raise your salary, and endeavor to assist your struggling family, and we will discuss your affairs this very afternoon, over a Christmas bowl of smoking bishop, Bob! Make up the fires, and buy another coal-scuttle before you dot another i, Bob Cratchit!"

Scrooge was better than his word. He did it all, and infinitely more; and to Tiny Tim, who did NOT die, he was a second father. He became as good a friend, as good a master, and as good a man, as the good old city knew, or any other good old city, town, or borough, in the good old world. Some people laughed to see the alteration in him, but he let them laugh, and little heeded them. His own heart laughed; and that was quite enough for him.

He had no further intercourse with spirits ever afterwards; and it was always said of him, that he knew how to keep Christmas well, if any man alive possessed the knowledge. May that be truly said of us, and all of us! And so, as Tiny Tim observed, God bless us every one!

THE NEXT STORY OF FAMOUS BOOKS IS ON PAGE 6567.

FLOWERS
of the
POETS

WHEN we are reading either prose or poetry of English authors, we constantly find references to flowers. Some of these are very familiar to English people, but for many of us the quaint old names rarely call forth any mental picture of the plants, except of a few such as the daisy, the daffodil, the rose and the violet.

Yet around some of them a wealth of legend and folklore has arisen, and their very names, various as they may be, reveal glimpses of history and custom, or of the keen observation of nature that has contributed toward their naming. Many plants received their titles when fairies were abroad in the land and needed thimbles and stools and rings to dance in. Others won their names by their colors or by their uses, and by their resemblance to something else.

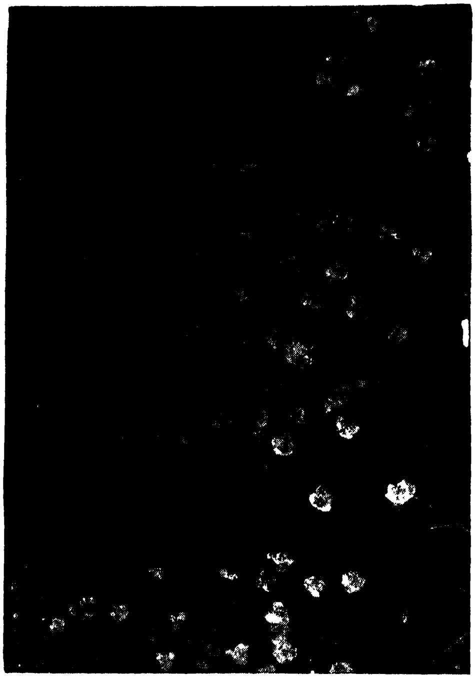


Photo by L. W. Brownell

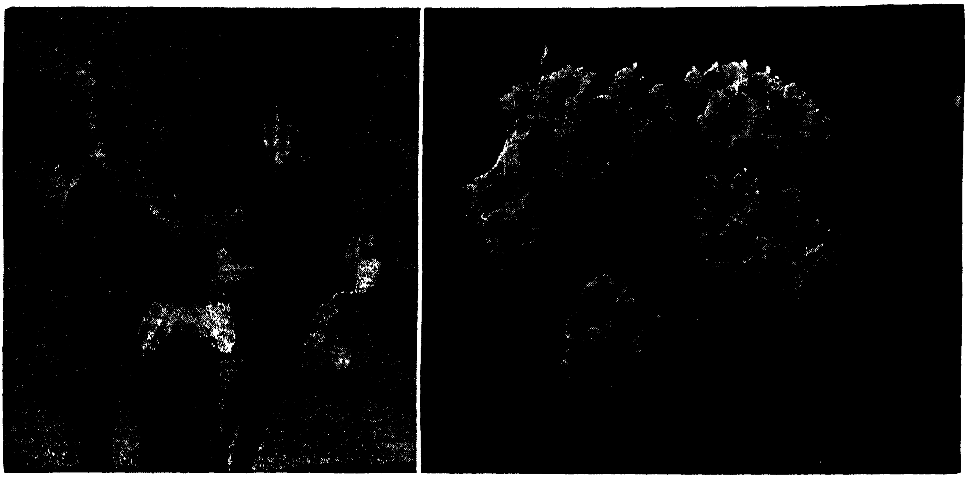
The harebell, beloved of Scotland's poets.

Photo by L. W. Brownell

The frail, graceful narcissus.

As our shadbush blooms when the shad are running, so the cuckoopint of Great Britain enters into its prime when the cuckoos begin to call in the budding trees. It is an arum not unlike our jack-in-the-pulpit or skunk cabbage, and, strange as it may seem, is a distant relative of the exquisite white calla. It has a great many common names, as lords-and-ladies and wake-robin, and the fruit is called snake's meat, poison berries and various other scornful names. Toward the end of January or early in February the great glossy green arrow-shaped leaves of the cuckoopint break through the earth, at first rolled up, but soon expanding, and then many of them show purplish black blotches. The Latin name *Arismoena* means "bloody arm" and refers to these dark purple stains of the spathe. An old legend claims that at the time of the Crucifixion

Beneath the cross it grew,
And in the vase-like hollow of the leaf,
Catching from that dread shower of agony
A few mysterious drops, transmitted thus
Unto the groves and hills their healing strains,
A heritage for storm or vernal shower
Never to blow away.



Photos by L. W. Brownell

The golden daffodil and the butter-colored English primrose have become poetic symbols of the springtime.

It is not until late in March or early in April that the pale yellow-green hoods come up and open their fronds, revealing the purplish poker-like pin. Most people regard this hood as the flower of the cuckoopint, but it is really only an outside covering. If we tear it carefully aside, we shall find that the real flowers, in great numbers, are clustered round the lower part of the pin. Looking at the hood, we shall see that it has a sort of waist, which divides the open upper part from the closed lower part, and, inside, the two parts are farther separated by a fringe of hairs standing out from the pin, or pintle, as it is named.

The flowers are below these hairs, very small, and without either sepals or petals. First there is a crowded band of stamens, and below these a similar band of crowded pistils. The hairs of the fringe above them all bend slightly downward. The pistils are mature before the stamens are ready to shed their pollen; and those who have carefully studied the plant and its peculiarities tell us that when the pistils are ready the cuckoopint sends forth an unpleasant odor, which is attractive to certain small hairy winged flies that fly to it and, seeing the purple pintle, think it is something in which they can lay their eggs.

Finding out their mistake, the flies follow the scent to the lower part of the hood. The fringe of hairs bends to let them pass, but springs back at once to shut them in, for the hairs will not bend upward. When autumn comes we see the result of the work of these little flies in the bright red berries clustered around the remains of the pintle.

In some British woodlands in March or April we may come across great spaces that are turned to gold by the nodding trumpets of the daffodil, or Lent lily.

The poet Wordsworth, sauntering along one day, somewhat pensive and sad, came upon a glorious sight:

> A host of golden daffodils
> Beside the lake, beneath the trees,
> Fluttering and dancing in the breeze.
>
> Continuous as the stars that shine
> And tremble on the milky way,
> They stretched in never-ending line
> Along the margin of a bay.
> Ten thousand saw I at a glance,
> Tossing their heads in sprightly dance.

Over and over again do the poets refer to the early blossoming of the daffydowndilly:

> When daffodils begin to peer,—
> With heigh! the doxy o'er the dale,—
> Why, then comes in the sweet o' the year:
> For the red blood reigns in the winter's pale.

Though like a lily, it does not belong to that family, but to the amaryllis family. In some parts of Europe and the United States it has escaped from cultivation and grows wild, but is oftener found in gardens. It belongs to the genus *Narcissus* of which there are several species and many varieties.

We usually know them as the narcissus, the jonquil and the daffodil. The last is marked by its trumpet and only one flower grows on a scape. The jonquil has two to five fragrant yellow flowers. We find the many varieties of the narcissus proper both in white and in various shades of yellow. Some varieties of all of them are double, and some show both white and yellow in the same flower, or two shades of yellow. In the pheasant's eye narcissus there is a touch of red or crimson.

THE PALLID GOLD OF THE EARLY PRIMROSE

The rather pale primrose, "the firstling of the year," comes with the daffodil, and is the most renowned of the primrose family.

> First came the primrose,
> On the bank high.

It has a salver-form corolla, with a widely flaring, five-parted brim. Five stamens spring from the tube of the corolla; sometimes from near its base, with a long pistil, sometimes from near its top, with a short pistil. In the latter case they are called "thrum-eyed," in the former "pin-eyed." The lower stamens, in the one form, are just about on the same level as the stigma in the form with a short pistil. Thus a bee, down-thrusting his proboscis in the one, gets it well dusted with pollen in just the place to have it brushed off by a pistil in a similar position, and the upper stamens power the proboscis for the long pistil. "Hence we see that by this beautiful arrangement, insects must carry the pollen of the long-styled form to the short-styled, and vice versa."

The clover, or "meadow honeysuckle," belongs to the pea family. Its head consists of a number of little florets, each shaped somewhat like a tube with a mouth toward the outside. Only bees and butterflies, with their long tongues, can enjoy the brimming wells of nectar waiting for them at the base of the tube. The bee is the more profitable visitor, for as it sips it depresses the lower lip of the flower and gets well dusted with the pollen or yellow powder. This, in the course of visiting the next flower, the bee transfers to its stigmas, and thus the clover is fertilized and increased.

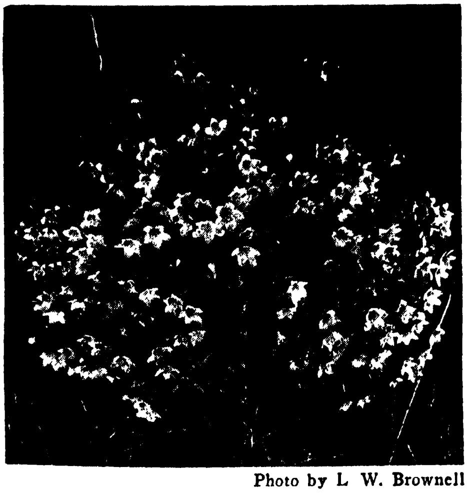
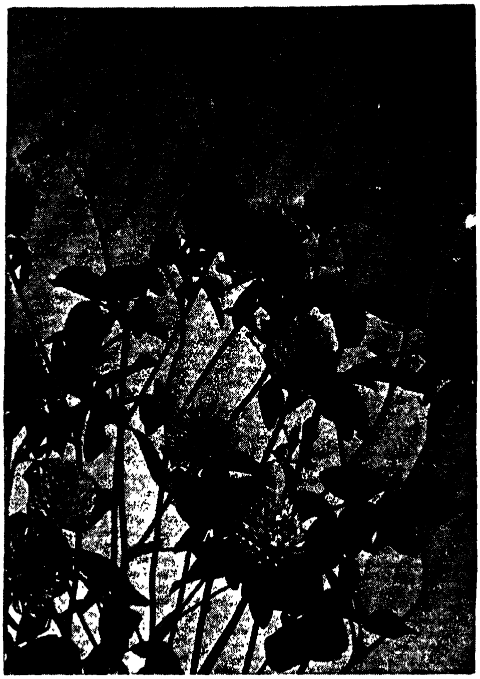


Photo by L W. Brownell
"Yellow cowslips paint the grass."



Clover is the favorite flower of the honey-bee.

"To live in clover" is certainly, from an insect's point of view, a luxurious and rapturous experience. In the course of history the clover has been given many mystic qualities. To find a four-leaved clover is accounted all sorts of good fortune. Watch the leaves at evening and you will find that they fold downward, the side ones like two hands folded in prayer, the end one lowered over them. It is believed that the plant does this to protect its sensitive surfaces from cold.

It is April and May in England

> When daisies pied, and violets blue,
> And Ladysmocks all silver-white,
> And cuckoo-buds of yellow hue
> Do paint the meadow with delight.

The four-petaled flowers of the ladysmock which, in spite of Shakespeare, are sometimes mauve, are of similar form to those of the wallflower, and the two plants belong to the same family, but the leaves are very different from those of the wallflower. The flowering stem is not sent up until spring, and on it there are much shorter leaves with the leaflets long and slender instead of round. The seeds are in long slender pods like those of the wallflower.

COWSLIPS OFFER SHELTER TO THE FAIRIES

About the time the milkmaid is in flower we ought also to find the cowslip. Its near relative, the primrose, is a plant of the woods, and is not particular as to the kind of soil, so long as there is plenty of leaf-mold above it. But the cowslip is fond of heavy soils, such as clay loam and chalk loam; consequently it is not to be found on light sandy soil, but is a distinct meadow plant. In some districts the meadows are thickly studded with clumps of cowslips, their yellow flowers standing high above their rosettes of leaves. "Yellow cowslips paint the grass."

The cowslip flowers grow in a cluster right at the summit of the juicy flower stem, which has no leaves at all and is therefore called a scape. The five sepals are united into a calyx, and the five petals into a corolla, the teeth of the calyx and the lobes of the corolla showing the number of parts of which they are made up. There are five stamens attached to the corolla tube, and the pistil has a rounded stigma like the head of a pin. As in the primrose, there are two kinds of flowers, one with the anthers of the stamens almost closing the mouth of the corolla tube and the stigma almost halfway down the tube, and the other with the stamens halfway down the tube and the stigma at its mouth. All the flowers on one part are of one kind only, the two forms never growing on the same plant.

The "cowslips wan" are the legendary retreat of fairies, who creep into them during showers.

SQUILLS AND BLUEBELLS OF SCOTLAND

People living in America are likely to be puzzled by the frequent references to bluebells in English books. On this side of the water the bluebells of Scotland are those that we think of first—those nodding campanulas that dance, not only on the heaths of Scotland, but on our northern cliffs and rocky hillsides. However, in England, quite another flower is sometimes meant, the delicate hyacinth-like, fragrant squills that we often

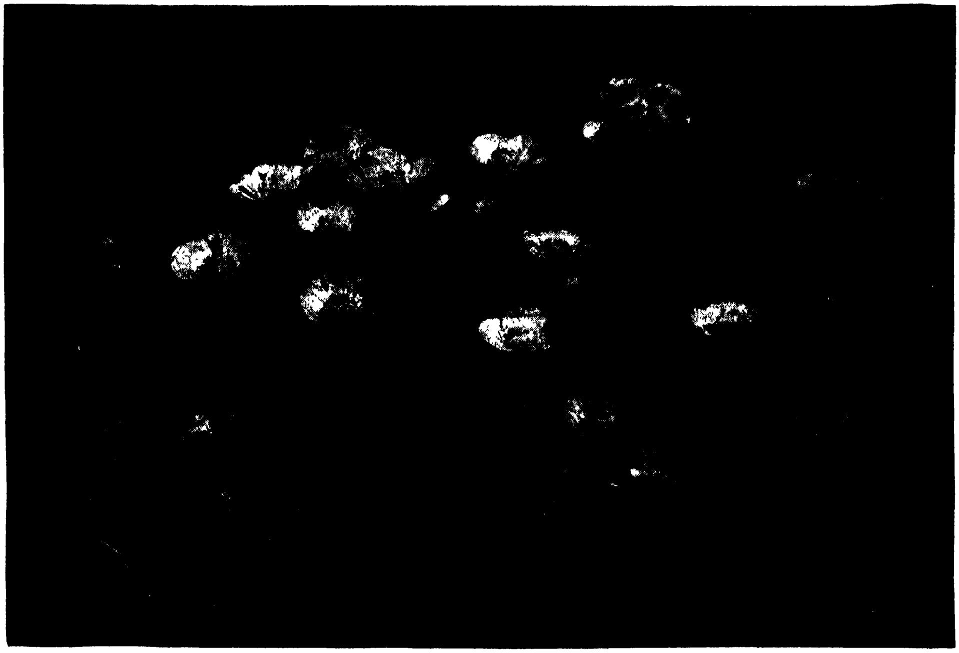


Photo by L. W. Brownell

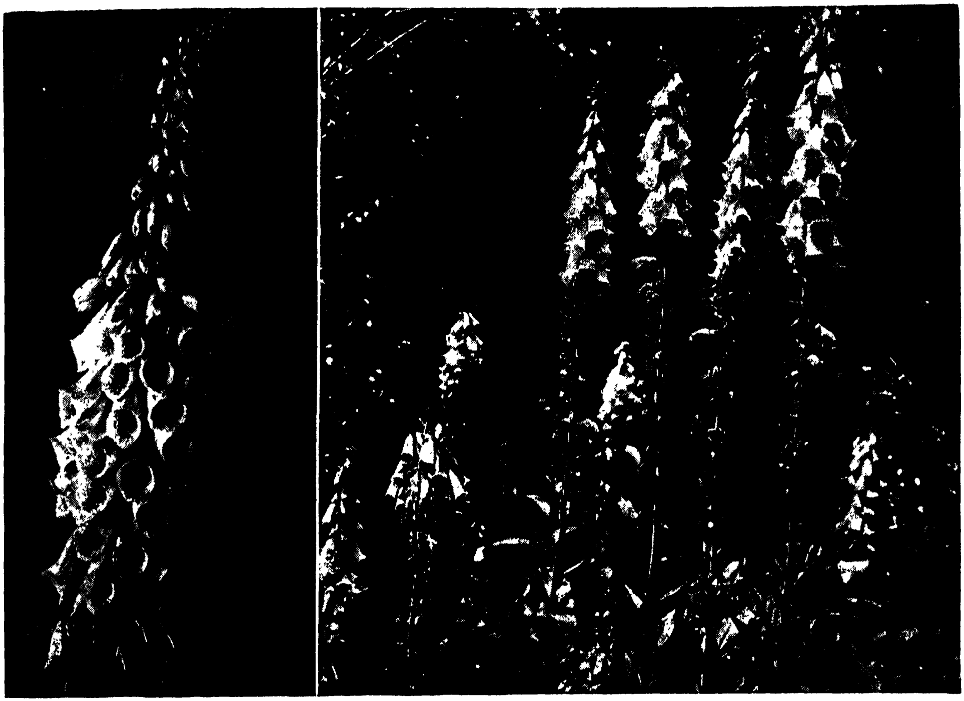
The cheerful buttercups make our pastures and fields gay and little children love to gather the satiny blossoms.

find in our gardens—generally known as scillas—and that, blooming very early in spring, "purple all the ground with vernal flowers."

How many million Aprils came
  Before I ever knew
How white a cherry bough could be,
  A bed of squills, how blue!

"Mourn, little harebells o'er the lea," cried Burns, referring to the flower that is the darling of Scotland, that overtops the heaths and the heather. Elsewhere he speaks of "heather-bells," which is the proper name for them; but the Scots shortened the name into hea'er-bell, and the English know it as harebell. It is so delicate and fragile that Scott, in describing his Lady of the Lake, wrote:

E'en the slight harebell
Raised its head
Elastic from her fairy tread.



Photos from W. Atlee Burpee Co.

The foxglove, more than any other flower, seems to belong to the world of elves and witches and magic spells, and much fairy lore has grown up about it. The botanical name of the plant, Digitalis, comes from the Latin word for finger, probably because the long flower-buds look rather like the bunched fingers of a hand.

The pendent position of the harebell not only favors the bees which alight by clinging to the pistil and reaching far into the bell to get at the nectar at the base of the stamens, but prevents undesirable visitors from entering. It also, by forming a roof, protects the pollen from rain.

And this is very important, for the whole tribe of bellflowers, or campanulas, are capable of self-pollination, so that if insects fail to cross-fertilize them, they can still perfect the seed. Other campanulas are also called bluebells. One kind, having run wild, sends up tall spines of violet bells along shady roadsides, gaily glowing among the weeds.

As spring advances its pageant glows ever more gorgeously. Who that has seen the sheen of buttercups beneath an elm tree will ever wholly forget the sight! Blue sky, running water, white clouds, the tender spring green of trees—it is a scene that has inspired many a poet.

And all the meadows, wide unrolled,
Were green and silver, green and gold,
Where buttercups and daisies spun
Their shining tissues in the sun.

Most of us have used the buttercup to test our fondness for butter! Farmers do not care for these lovely flowers in the pastures, because cattle will not eat its acrid, caustic stem and leaves. The earliest buttercup is the bulbous buttercup, which by storing up nourishment underground all winter steals a march on its fibrous-rooted sister that accumulates hers in the spring. It is a low and more hairy plant, but very like the tall buttercup in other respects and, like it, a naturalized European immigrant.

Photo by L. W. Brownell

Berries of the deadly nightshade, a poisonous plant. A drug obtained from it, belladonna, is sometimes used to enlarge the pupils of the eyes.

THE FOXGLOVE'S CURIOUSLY MOTTLED BELLS

Near them, perhaps, will shoot up into tall spires, "stately foxgloves fair to see," from among their large wrinkled leaves; and more than half of the four-foot length of stem is covered with the large purple-spotted crimson bells. The stamens and pistil are so carefully placed upon the upper wall that the portly bumblebee, as it crawls in to get at the nectar, can not fail to bring and carry off the pollen; while smaller insects are kept out by fringes of long hairs that stick in their faces. *One foxglove plant produces a million and a half of seeds!* There is much questioning as to the origin of this name. In several languages, the likeness of the flower to a glove-finger or a thimble has been noticed, and in England it was supposed that fairy folk donned them for headgear, while witches used them for thimbles. A useful medicine called digitalis is extracted from the velvety leaves of the foxglove, although the plant, as a whole, is poisonous if eaten by animals or human beings.

Another poisonous plant, but also medicinal, is the deadly nightshade, and all must beware of touching its big black, cherry-like berry. This plant is bushy, about three feet high, with broad oval leaves. The drooping flowers are bell-shaped, greenish purple in color, and are produced singly. The whole plant is poisonous, and even the plucking of a spray may cause trouble to our eyes, so we must not touch it.

> Foxglove and nightshade, side by side,
> Emblems of punishment and pride.

But the little heartsease is not poisonous.

> By scattered rocks and turbid waters shifting,
> By furrowed glade and dell,
> To feverish men thy calm, sweet face uplifting,
> Thou stayest them to tell
>
> The delicate thought that cannot find expression,
> For ruder speech too fair,
> That, like thy petals, trembles in possession,
> And scatters on the air.

Its flowers are seldom much more than an inch across, and often smaller; their shape and markings are just like garden pansies. At the base of the leaves there appear to be smaller leaves, but they are really stipules. In the pansy they are large and leaf-like, so they are commonly looked upon as leaves. Usually the petals are white with yellow and purple lines, but sometimes the upper petals are purple and the lower ones yellow.

The purple lines all run to the entrance to the nectar tube, where there are two yellow spots, so that long-tongued insects will not miss the way.

THYME IS A MEMBER OF THE MINT FAMILY

"I know a bank where the wild thyme blows," says Oberon, and a wonderfully odorous and bee-haunted bank it would doubtless be. While it grows in its evergreen low tufts it is very fragrant and pretty. Even its pale flowers standing thickly at the tips of the branches are of a pleasing rosy tint. The garden thyme is very similar, but comes from the Mediterranean shores. It is one of the aromatic mint family.

The typical flower of the British grain fields is the scarlet poppy. In June, when the wheat stalks have not yet reached their full height, many grain fields appear from a distance to have nothing but poppies in them, and are a sheet of blazing scarlet. During the first World War the poppy of the Belgian fields of battle won for its species a glorious immortality. No longer the symbol of forgetfulness, today it stands to remind the world of sacrifice willingly offered; of a debt that the living never can repay.

> In Flanders fields the poppies blow;
> Between the crosses, row on row,
> They mark our place.
>
> . . . .
>
> Take up our quarrel with the foe;
> To you from failing hands we throw
> The torch; be yours to hold it high.
> If ye break faith with us who die,
> We shall not sleep, though poppies grow
> In Flanders fields.

In contrast to the poppy is the charming guelder rose, which attracts attention to its fruit-bearing treasures by the circle of gay, but otherwise useless, flowers. By gradually increasing the number of these snowy, sterile florets, the florists have built up the white globes that are so familiar in old-fashioned gardens.

There is no more beautiful flower song in literature than that which Tennyson gives us in MAUD. The lover is waiting in a flower-scented garden in the warm blackness of the summer night.

Photo from Brooklyn Botanic Garden

The fragrant clusters of the lilac, and its delicate heart-shaped leaves, delight the hearts of dwellers in both town and country in the spring.

> There has fallen a splendid tear
> From the passion-flower at the gate.
> She is coming, my dove, my dear;
> She is coming, my life, my fate;
> The red rose cries, "She is near, she is near";
> And the white rose weeps, "She is late."
> The larkspur listens "I hear, I hear";
> And the lily whispers, "I wait."

There is one more flower, or rather flowering shrub, the lilac, which is beloved of the poets, and which all of you who live in the country have seen, both in purple and white, and have loved the odor, which Mrs. Stephens has described.

> I am thinking of the lilac-trees
> That shook their purple plumes,
> And when the sash was open
> Shed fragrance through the room.

Or perhaps you have read in THE BARREL ORGAN, by the English poet Alfred Noyes

> Go down to Kew in lilac-time, in lilac-time, in lilac-time;
> Go down to Kew in lilac-time (it isn't far from London).
> And you shall wander hand in hand with love in summer's wonderland;
> Go down to Kew in lilac-time (it isn't far from London).

Walt Whitman, the Good Gray Poet, wrote WHEN LILACS LAST IN THE DOORYARD BLOOMED, one of the most sorrowful poems in our language. It breathes the poet's deep grief on the death of Abraham Lincoln.

The lilac is a shrub belonging to the olive family and is a native of western Asia. It was brought to Europe from Persia over three hundred years ago, and the English colonists brought it with them to America, where it thrived and has been carried to every part of the United States and southern Canada. In driving through New England one often sees the shrubs beside the road, perhaps marking the site of a house that has disappeared long ago.

It grows as high as fifteen feet, and is very hardy, but if not pruned may be choked by suckers which come up from the roots. It bears its fragrant flowers in clusters at the end of the twigs, and a lilac hedge in full bloom gratifies both the eye and the sense of smell. There are several species and many varieties, ranging in color from a dark bluish purple, through delicate lavender to pure white.

THE NEXT STORY OF PLANT LIFE IS ON PAGE 6272.

Official United Nations photo

The Social and Economic Council in session. It will work to free the world of the economic and social causes of war.

THE UNITED NATIONS

EARLY in World War II, the nations that were ranged against the Axis became known as the United Nations. As the war spread, more and more nations joined their ranks until, when the war ended with the unconditional surrender of Japan, the number of the United Nations had reached a total of more than fifty.

All continents, all climates and all races of mankind are found among the United Nations. Their people live in places as unalike as you can imagine, from the jungles of Africa to the great cities of western Europe and North America. Some have great wealth and some are as poor as they can be. These many millions of people make their living in all kinds of different ways.

There is the same wide wariety in their religious beliefs and in their ideas of government. The United Nations include democracies and dictatorships, monarchies and republics. There are states—such as ours—where the railroads and telephone lines and banks and mines are owned and managed by individuals or private corporations. We call this system free enterprise. In other states among the United Nations, the governments own and manage the banks and mines and railroads, and so on. We call this system socialism.

But all these many nations, so different from one another, had one compelling aim in common. They were grimly determined to survive by defeating the efforts of Germany and Japan to enslave them.

As long as they were faced with the pressing danger of defeat, the United Nations spared no effort to help each other against a common foe. Britain and the United States supplied naval power and so, to a lesser degree, did other countries—notably Norway and the Netherlands. Britain and the United States furnished most of the air power. Russia and the United States, with their great populations, gave the bulk of the land armies.

The United States, because of its enormous industrial resources, was the arsenal of the United Nations. It furnished a tremendous flood of munitions, guns, tanks, airplanes and other war equipment. Britain and Canada, too, made war equipment for the United Nations. Britain and Australia served as bases from which the campaigns were launched that ended in the defeat of Germany and Japan. Belgium, France, the Netherlands and Britain placed the raw materials of their colonies at the disposal of the United Nations. Other vital raw materials were furnished by countries of Latin America. Tin, for instance, was furnished by Bolivia; rubber, by Brazil.

Resistance groups in all European countries aided the common cause. Such groups, because they worked in secret, were known as the Underground. The brave men, women and children of the Underground prevented Hitler from establishing complete control over the Continent, and helped to prepare the way for Allied invasion. In the Philippines, guerrillas, hidden from the Japanese, snatched at every chance to kill or sabotage the enemy. Soldiers, sailors and airmen of the United Nations fought bravely side by side, some in the steaming jungles of Burma and on the Pacific Isles, some in the deserts of Africa and others in the hedgerows of Normandy. On all the seven seas as well as in the air above all theaters of war, they proved their courage and comradeship.

In this common struggle the interests of the United Nations became closely interwoven. People in danger of destruction have little time to think of national prestige or of saving face. Americans, British, Canadians, Frenchmen and others fought against the Germans as one great united force under the command of an American leader, General Eisenhower. Similarly, Americans, British, Chinese, Indians and others fought as one great force in southeast Asia under the command of a British leader, Admiral Lord Mountbatten.

The United Nations pooled their resources of raw materials, food, manufactured goods and ships, and distributed these where they were most urgently needed. This was an enormous task. It was carried out through the Combined Boards in Washington, of which the United States and Britain were the most important members.

Another tremendous task was that of working out together the plan of the war. This was done through the Combined Chiefs of Staff of the United States and Britain, who worked closely with the military leaders of the other United Nations. Such remarkable team work, on so huge a scale, had never before been known. Not one of the United Nations could have won the war alone. It was team work that made it possible for them to defeat Germany and Japan.

We all know, however, that military victory is not enough. If the partnership built up by the United Nations in wartime should fall apart, the Germans and Japanese might recover their strength at some future date. They might once more catch us off guard if we and our allies are no longer united. How should we carry over into peacetime the cooperation we so effectively developed in time of war?

This question was being studied by President Roosevelt and Prime Minister Churchill long before the war was over. In order to find an answer to the question, they, and other Allied leaders, decided to create a number of international agencies in which the United Nations would begin to prepare for the enormous problems of peace. In the grim years when victory seemed still tragically

THE UNITED NATIONS

THE BIG FIVE

China
Union of Soviet Socialist Republics
United Kingdom
United States of America
France

. . . .

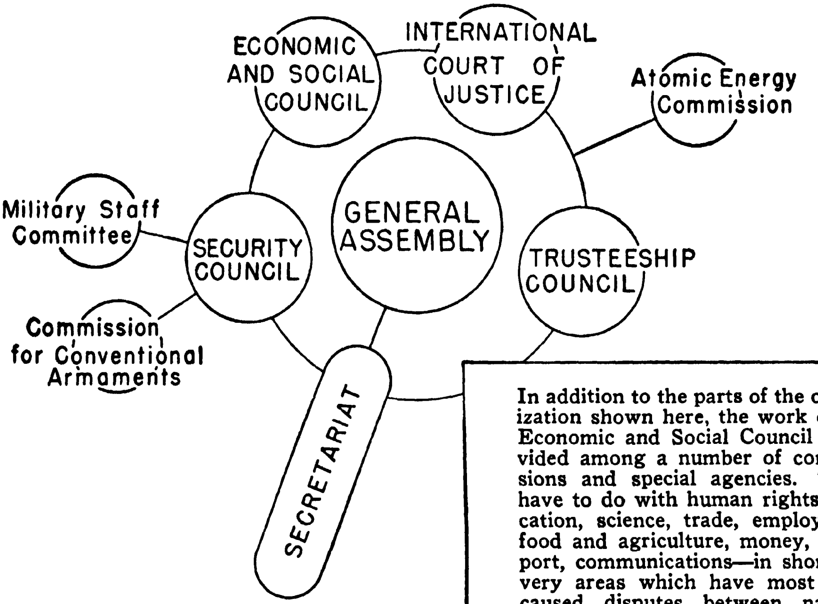
Afghanistan
Argentina
Australia
Belgium
Bolivia
Brazil
Burma
Byelorussian Soviet Socialist Republic (White Russia)
Canada
Chile
Colombia
Costa Rica
Cuba
Czechoslovakia
Denmark
Dominican Republic
Ecuador
Egypt
El Salvador
Ethiopia
Greece
Guatemala
Haiti
Honduras
Iceland
India
Iran
Iraq
Israel
Lebanon
Liberia
Luxemburg
Mexico
Netherlands
New Zealand
Nicaragua
Norway
Pakistan
Panama
Paraguay
Peru
Philippine Republic
Poland
Saudi Arabia
Siam
Sweden
Syria
Turkey
Ukrainian Soviet Socialist Republic
Union of South Africa
Uruguay
Venezuela
Yemen
Yugoslavia

distant, the United Nations held a series of conferences. It was their business to consider ways by which nations might co-operate after the war.

The Food Conference at Hot Springs, Virginia, established the Food and Agriculture Organization in 1943.

The United Nations Relief and Rehabilitation Conference at Atlantic City, New Jersey, set up the United Nations Relief and Rehabilitation Administration in 1943.

The Organization of the United Nations



In addition to the parts of the organization shown here, the work of the Economic and Social Council is divided among a number of commissions and special agencies. These have to do with human rights, education, science, trade, employment, food and agriculture, money, transport, communications—in short, the very areas which have most often caused disputes between nations.

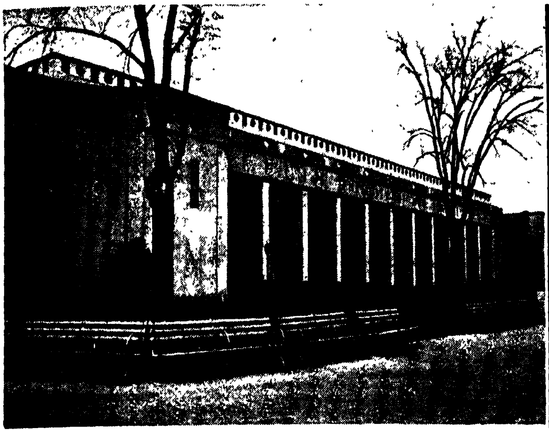
An Allied conference on education was held in London in April, 1944.

The Monetary and Financial Conference at Bretton Woods, New Hampshire, laid plans for an International Monetary Fund and an International Bank in July, 1944.

A civil-aviation conference in Chicago established an international civil aviation board in November-December, 1944.

All these agencies dealt with special, technical questions, and could not be expected by themselves to insure co-operation among the United Nations over a long period of time. Such special agencies needed to be fitted into a wide union, or club of nations. This could offer some hope of peace and comfort to all nations, large and small. Plans for such an organization were mentioned at the Moscow Conference of the United States, Britain and Russia in 1943. A year later, at a meeting held at Dumbarton Oaks near Washington, D. C., August 21-October 7, 1944, representatives of the "Big Four"—the United States, Britain, Russia and China—drew up proposals for a United Nations organization.

An important gap left in the Dumbarton Oaks proposals concerned the way in which the Security Council of this organization would vote. This gap was filled in at the Yalta Conference, February 4-12, 1945. At Yalta, in the Crimea, were President Roosevelt, Prime Minister Churchill and Marshal Stalin. Shortly after this meeting, representatives of the United States and of nineteen Latin-American countries met in Mexico City. Argentina, alone of the American republics, was not represented. At this meeting, February 21 to March 8, 1945, the Act of Chapultepec was adopted. This agreement provided for the defense of the Western Hemisphere in time of war. It is expected that many such regional agreements will be reached in the future. Finally, fifty of the United Nations (page 6133) gathered at the San Francisco Conference, April 25-June 26,



Official United Nations Photos by Al. Fox

Until it has its own building at UN headquarters, the General Assembly will meet at the City of New York Building at the World's Fair grounds in Flushing, New York. Right; Trygve Lie, Secretary General of UN. Mr. Lie, a Norwegian, was elected by the members of the General Assembly.

1945, to consider the Dumbarton Oaks proposals. It was necessary to change these proposals so that they would fit into the general scheme of the Act of Chapultepec and regional security agreements which Russia had made with Britain, France, Poland, Czechoslovakia and Yugoslavia. At the close of the San Francisco Conference, representatives of the nations present signed the charter of a United Nations organization. The charter is accompanied by the statute of the International Court of Justice.

This voluntary union of nations became commonly known as the United Nations, or UN for short. It consists of: the General Assembly, the Security Council, the Trusteeship Council, the Secretariat and the International Court of Justice.

In the General Assembly all nations, large and small, have an equal voice. The General Assembly is intended to serve as a "town meeting" for the United Nations, where all can say what they think. It is to meet at least once a year, and more often if necessary.

On the Security Council sit representatives of eleven member nations. The United States, Britain, Russia, France and China are permanent members. The other six members are to be chosen for terms of two years each by the General Assembly.

Meetings of the United Nations are held just outside of New York, and that city will be its permanent headquarters, through the generosity of John D. Rockefeller, Jr. In 1946 he gave the organization a large parcel of land on the East Side; and buildings are being erected there. A representative of each of the eleven member nations of the Security Council must always be present at headquarters, so that the council will be able to hold its meetings and do its work every day, year in, year out.

The great purpose of the Security Council is to maintain world peace and to take steps against any nation that threatens the peace. Its decisions can be questioned in the General Assembly by any of the United Nations. But their discussions can not prevent the Security Council from taking prompt action in an emergency.

In its difficult task of maintaining peace, the Security Council will be aided by a Military Staff Committee. Each nation-member of UN undertakes to tell the Council what armed forces and facilities it will place at the Council's disposal. Each member will supply air-force groups to the Security Council, so that the Council may be able to act promptly against an attacking country.

The Security Council will be able to use these planes and other military forces on one condition only—when all five of the great powers agree that they be used. One of the rules of the Security Council is that each great power has the right to veto—that is, to forbid—the use of force in maintaining peace. Therefore, no effective action can be taken against an aggressor without the consent of the Big Five. This right of veto is the weakest spot in the United Nations. Either the United States or Britain or Russia or China or France may, by its veto, prevent the Security Council from taking action.

The Economic and Social Council is responsible to the General Assembly. It will deal with the prosperity and the welfare of people in all nations. It may become as important in its field as the Security Council will be in keeping the world safe from an aggressor. The various United Nations agencies which we have already discussed, and others that may be created in the future, are to be fitted into the Economic and Social Council. This Council is to be composed of representatives of eighteen nations, chosen without considering their military or industrial strength, and it is in this Council that the small nations can make a most valuable contribution to the work of UN.

Another important organ which is also responsible to the General Assembly is the Trusteeship Council. In the San Francisco Charter, the United Nations agreed to advance the welfare of dependent peoples and to promote their "progressive development toward self-government or independence." UN may act as guardian, not only for territories taken from Germany, Italy and Japan as a result of the war, but also for colonies now controlled by the United Nations. The administration of any territory placed in trust with UN will be supervised by the General Assembly through the Trusteeship Council. On the other hand, the development of any part of such a territory designated as strategic will be supervised by the Security Council.

The Secretariat will supply the people and the facilities to operate all the various parts of UN, and will carry out their technical work. The Secretariat is to be headed by the Secretary-General of UN. The international Court of Justice will consider disputes voluntarily brought before it by nations.

The charter was signed by the representatives of fifty nations on June 26, 1945. Then one more step was necessary. To bring the charter into force, it had to be ratified by the governments of at least twenty-nine nations.

The United States was the first of the powers to accept the San Francisco Charter. On July 28, the Senate ratified the document by a vote of 89 to 2. This was a remarkable contrast to the refusal of the United States, in 1919, to join the League of Nations.

The twenty-ninth nation ratified the charter on October 24, 1945, and the charter became a part of the law of nations. The twenty-ninth ratification was that of the Union of Soviet Socialist Republics.

The UN is an experiment. Whether or not it works will depend on all of its member-nations. But if we co-operate with each other, we can strengthen the web of our mutual interests. Co-operation will some day prove to be a greater safeguard against war than the most costly armaments.

By VERA MICHELES DEAN.

THE NEXT STORY OF ALL COUNTRIES IS ON PAGE 6190.

Official United Nations Photo

An important part of peacemaking is the distribution of food to the starving peoples of Europe and Asia. UNRRA, the UN relief agency, maintained soup kitchens such as this in stricken areas for three years.

JOHN MAYNARD, PILOT

ONE hundred years ago a paddle-wheel steamer was creeping through smooth waters toward its home port, after a long and dangerous journey. Now the port was near. On this last night the passengers and most of the crew were sleeping peacefully. The captain, who had stayed on the bridge through days and nights of treacherous fog, was having a few hours of rest.

On the bridge was a pilot, John Maynard, who had come out from the harbor to bring this great ship safely home. He knew every inch of the harbor waters, and he stood at the wheel calmly guiding the steamer through its last perils.

It was one of those dark nights at sea when it is impossible to catch a glimpse of the vast ocean through which ships make their way. Not a star shone in the sky. The little discs of light made by the portholes soon perished in the wall of darkness enclosing the ship. The only sounds were the grinding of the paddles and the deep, low murmur of the smooth sea. It was a fitting night for the end of a dangerous voyage, for the peace and rejoicing of a homecoming.

But suddenly a terrible cry was heard above the sea—a cry of "Fire!"

Gone now was the darkness. Every face was visible. Every line of terror could be seen in that frightful glare. And another sound was added to the moan of the sea and the noise of the paddles—the rushing, roaring, hissing sound of fire that leaped in a writhing cloud of flame and smoke to the sky.

The captain cried out in a loud voice: "Listen! In half an hour more we may reach land. Our lives may yet be saved. It rests with the pilot. If he can hold on at his post we shall reach the land." He turned around, and called: "John Maynard, are you there."

A quick answer came from the bridge: "Aye, aye, sir!"

In an instant, despair was turned into hope. That answer was so strong, so confident and it had come so quickly. Only ten minutes. Surely they would be saved! John Maynard could see laughing women kissing their babies, and fathers smiling into the eyes of their sons.

The great ship, now a driving shape of flame, cut through the smooth and dangerous water at its highest speed, a race against fire! But John Maynard was at the wheel!

Would they reach the land in time? With every turn of the paddles they were nearer to safety; but with every second the flames increased in fierceness.

What of the pilot? Was he still safe at the wheel?

"Are you there, my lad?" cried the captain.

There was no answer.

The passengers felt their hearts sink, and a new terror possessed them. They stood silent. But, just as they abandoned hope the answer came—so slow, so choked, so difficult that it was hard to believe that the same man spoke.

"Sir, I'll try," said John Maynard.

The thoughts of the passengers, at that instant, were turned from the faithful pilot. The lights on land suddenly stood out before them in the distance. A loud cheer ascended from the decks. They were saved. The race against fire had been won. Land was near; houses were visible; the towers of churches, the names of shops and the lamps in the street came into view. Boats could be seen putting out to them.

John Maynard, from the bridge, could see mothers clutching their children to their hearts. His own little son, his well-beloved, was asleep at home far away. The moving mass of roaring flame, which once had been a ship, reached the harbor.

Passengers threw themselves into the waiting boats. Not a thought was given to the pilot. On the sides of the harbor was gathered a dense multitude, watching the spectacle of a great ship on fire.

When everyone was saved, the boiler exploded with a deafening roar, and John Maynard was hurled into eternity.

Many men who stood on that flaming deck remembered to their dying day, as the most vivid impression of their lives, the look on John Maynard's face as he held to his post in the blinding smoke and the fierce fire.

A MAN WHO GAVE AWAY MILLIONS

IN THE year 1835 there was born in Dunfermline, Scotland, a poor little boy who was destined to become one of the world's great benefactors. His name was Andrew Carnegie. At the age of thirteen this Scottish boy emigrated with his parents to Allegheny, Pennsylvania. Andrew would have been happy to go to school, for he loved learning, but his parents needed his help so he was put to work in a factory at a salary of a little over a dollar a week. He knew that if he was to improve his station in life he must equip himself by knowledge; soon an opportunity arose to be messenger boy in a telegraph office. Excitedly he told his mother of his new job.

"Now I can learn to be a telegraph operator!" he promised her, and it seemed to both that this would be a very wonderful career for a man. He kept his promise, and became operator. Soon he was secretary to the superintendent of a large railroad; presently he was himself superintendent of a division. The Civil War came along, and he gave great service to the Federal cause, for he was placed in charge of the military telegraph and railway lines.

Carnegie was fortunate enough to live at a time when the oil lands of his state were just beginning to be developed, and when many railroads were being built. He saved his money and invested it in oil and railroad stocks. He studied the Bessemer steel process in England and organized mills for making steel rails for railroads that soon brought him enormous wealth.

Many a man would have accepted his good fortune as a tribute to his own skill; but Andrew Carnegie regarded his millions as a public trust. He remembered the days of his boyhood, when he had craved the luxury of books. He knew that there were in the world thousands of people, young and old, whose lives would be made happier and more fruitful if they could have access to the world's treasures of literature. Carnegie put in motion a plan to found libraries that would be free to the people.

He knew, canny Scotchman that he was, that people seldom appreciate what they acquire without effort; therefore his habit was to provide a town with a library building if the town itself would contribute the ground and guarantee to keep the library open. Almost three thousand libraries were thus established by him, and his gifts lent inspiration to other communities to build or repair their libraries. The final years of the nineteenth century and the early years of the twentieth were remarkable for the impetus given by Andrew Carnegie in establishing free library centers.

Carnegie also aided poor students in getting an education, and created a fund to pay pensions to college professors. He endowed a commission for rewarding heroism, aided many great institutions for learning and research, two of which bear his name; and gave millions for the cause of international peace. It is estimated that this poor little immigrant boy gave away, before his death in 1919, more than $350,695,000.

HOW THE SEA SAVED HOLLAND

SET in the midst of pastures, gardens, and orchards, with the Rhine River running through the streets in many channels, the city of Leyden, in Holland, was, in May, 1574, indeed a beautiful place. But the city, and indeed the whole country, was disturbed and unhappy. Philip II of Spain had inherited from his father the provinces of the Netherlands, not as part of the Empire, but as a personal inheritance. It is hard for us to understand how this could be, but in the sixteenth century small countries were not always given fair treatment. Philip considered the Netherlands his, to use as he saw fit and to tax as he liked. Philip was an autocrat, stubborn, bigoted and a firm believer in the divine right of kings.

The men of Holland possessed a vigorous, independent nature and a sense of thrift which made it hard for them to pay heavy taxes to a foreign ruler. The city of Leyden resisted Philip's demands and he sent an army under Valdes to beseige the town. Encouraged in their resistance by the Prince of Orange, the brave little garrison shut the gates of the city, and the inhabitants were put on a strict allowance of food.

THE PRINCE OF ORANGE PIERCES THE DIKES TO SAVE THE BESIEGED CITY OF LEYDEN

Now, Holland is below the level of the sea, which is only kept back by great dikes. The Prince sought means to bring food to the beseiged; but, with the Spaniards all around the town and along the coast, there seemed but one way. He could not send ships to Leyden by sea, but he could send the sea to Leyden, and let the ocean drive away the Spaniards. He would pierce the dikes, open the sluices, and so save Holland. The people were willing, and said: "Better a drowned land than a lost land."

And so, in August of that year, the dikes on the coast were burst, and the waters crept down over the country toward the starving city. The Spanish army watched the water rise higher and higher between the dikes, first with surprise, then with alarm. A Dutch fleet of two hundred vessels was fitted out and sent toward the city, which was, however, so well protected that it could not be reached for several weeks.

First a strong dike, the Landscheiding, five miles from the city, was captured and pierced. The boats sailed through the openings, but the next dike was found still one foot above the water, and when that was breached, the water beyond was too shallow to carry the boats, and they could advance only through a canal which was well guarded by the Spaniards. Alas for starving Leyden. The brave little fleet was repulsed, for the wind blew the waters back from the city, and the sailing ships with their precious cargoes of arms and food could not approach.

THE SPANIARDS RETREAT AS THE WATERS APPROACH THE STARVING CITY

On September 8, however, a gale arose from the northwest, and blew for three days, driving the waters nearer to the walls. Then the Spaniards started to retreat, as the waves, carrying the Dutch boats, advanced. Another long delay ensued, however, due to an easterly wind, and the Spaniards once more held their ground. Still the patient citizens, gaunt, feeble, racked by fever and pestilence, refused to yield. Some of them reproached the burgomaster for not yielding, but his courage and patriotism did not fail, and he answered: "I know that we shall starve to death if we are not soon relieved; but starvation is preferable to the dishonored death which is the only alternative. My life is at your disposal; but expect no surrender so long as I remain alive."

The people gained courage from his words; a dove flew into the city bearing a message of hope, and, on October 1, a gale blew the waters close up to the walls. On the flood floated the relieving fleet, and there was a sharp encounter with the Spaniards, whose boats were sunk. Now the fleet was within a few hundred yards, and the men, jumping out, shouldered the boats through the shallows. There remained but one more fort of the besiegers to be taken. At dead of night the citizens watched lights come out from it and flit across the water.

In the morning a boy was seen at the top frantically waving his cap. He was a Dutch boy, and had seen the Spaniards escape. So the fort was entered, and the fleet swept alongside the quays throwing bread to the starving people. Then men, women and children went to the cathedral, and thanked God for their deliverance, and, as a monument of their gratitude, they next year founded the famous Leyden University. The dikes were rebuilt and the brave provinces, having thrown off the yoke of Spain, became the Dutch Republic.

THE JUDGE WHO IMPRISONED A PRINCE

WHEN King Henry V of England was a youth, he and his brothers grew tired of the irksome ways of the court, and scandalized the King, their father, and the staid courtiers by their practical jokes and mad frolics.

Prince Henry often grieved his father by his reckless behavior when in the company of his gay associates. But his wild pranks seem to have been due more to boyish love of mischief and adventure and to boisterous spirits than to any real liking for wrongdoing. However, his conduct and that of his brothers ill became royal princes, and Prince Henry's familiarity with some of his future subjects vexed his royal father very much.

There is one story about Prince Henry, or Prince Hal, as the people liked to call him, which not only redounds to his credit by showing he could be staunch to a friend in trouble, and take punishment with good grace, but tells how a judge put justice before the favor of man. Prince Henry's brothers, Thomas and John, once supped far into the night with some of their boon companions, and the feast ended in a riot, at which the city authorities had to interfere. The Princes were angry at that, and as a result the Lord Mayor and aldermen were summoned before the King. He, however, soon dismissed them when they said they had merely done their duty in stopping a riot.

It was during another wild freak of this kind that one of Prince Henry's followers was charged and sentenced to imprisonment. When the Prince heard what had befallen his favorite, he came to the judge, Chief Justice Gascoigne, and ordered him to release his friend. But the judge, who feared the anger of the royal youth less than he feared the reproach of his own conscience, looked at him sternly, and told him justice must be done.

When Prince Henry saw that he could not overawe the judge, he grew very angry, and drew his sword threateningly. Then the judge called on the youth to recollect himself, and in the King's name he adjured the Prince to change his willful conduct and set a good example to those who would one day be his subjects.

"And now," he concluded, "because you are guilty of disobedience and contempt of this court, I commit you to prison. There you will stay until the King, your father, orders your release."

The hot-tempered Prince acknowledged the justice of the judge's words, and, laying his sword down, bowed to the courageous man who had sentenced him, and was then taken off to prison. It is said that when the King heard of what had occurred, he expressed his happy fortune in having for one of his judges a man who was not afraid to administer justice, and for a son a youth willing to submit to it.

Shakespeare, who wrote a great deal about Prince Henry in his plays, makes the King, his father, say these words:

> Happy am I, that have a man so bold,
> That dares do justice on my proper son;
> And not less happy, having such a son,
> That would deliver up his greatness so
> Into the hands of justice.

Prince Henry afterward treated Judge Gascoigne with much respect, recognizing that if he could keep so strictly to enforcing the laws of the country, even against the heir to the throne, who in the natural course of events would one day be his sovereign, then he would not regard the favor of any man, but seek to do his duty to all.

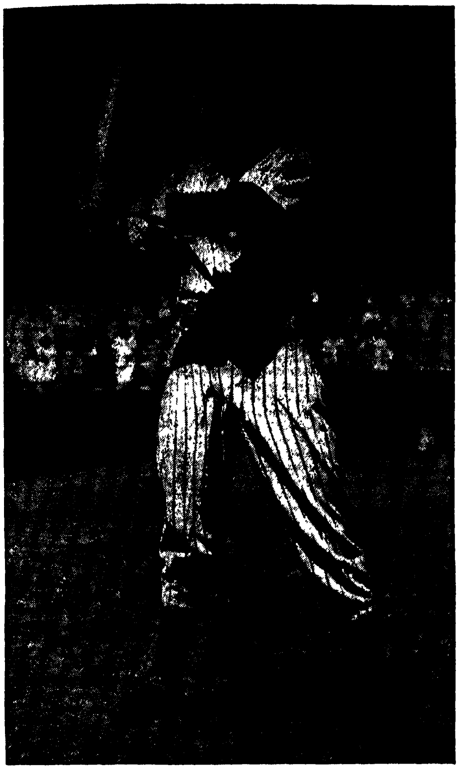
When Prince Henry came to the throne, he justified the people's trust in him, and Judge Gascoigne was one of the upright men he consulted. Shakespeare puts these words into the mouth of Henry V, when addressing the judge:

> . . . Still bear the balance and the sword;
> And I do wish your honours may increase
> Till you do live to see a son of mine
> Offend you, and obey you, as I did.

This is the King who, with a small, ragged army, won at Agincourt a brilliant victory over the French though outnumbered at least four to one.

THE NEXT STORY OF GOLDEN DEEDS IS ON PAGE 6292.

THE GAME OF BASEBALL



Cosmo—Sileo

1. One of the greatest players of all time—Joe DiMaggio, outfielder of the New York Yankees.

BASEBALL has been known for many years as the national sport of the United States. Although that title is now disputed by several other games, baseball is still very popular. Though tradition credits Abner Doubleday with developing baseball from an old English game, called rounders, there is much dispute about the origin of the sport. It seems clear, however, that a rather crude version of the modern game was played in the thirties of the last century. Baseball was played at first by amateurs for the sheer love of the game, and amateurs have played it in that spirit from that day to this.

As time went on, certain baseball players received a share of the admission money paid by spectators. In 1869, a salaried team, the Red Stockings of Cincinnati, made a tour of the country and overwhelmed opposing teams. Two years later, the National Association of Professional Baseball Players was formed; the players of the Association were organized in different clubs. In 1875, the various club-owners established the National League. This organization remained supreme in the professional baseball field until 1900, when a rival organization, the American League, was founded.

The modern game of baseball still appeals to many amateurs. The best baseball, however, is played by professionals. The National League and the American League, which are known as the major leagues or the majors, are the foremost baseball organizations in the world. The National League has teams in New York, Chicago, Pittsburgh, Philadelphia, St. Louis, Cincinnati, Brooklyn and Boston; the American League, in New York, Philadelphia, Detroit, Cleveland, Chicago, Boston, Washington and St. Louis.

There are also many minor leagues, graded from Class AAA to Class E. The basis of this rating is the total population of the cities in each league. The most important minor leagues, all AAA, are the American Association, the International League and the Pacific Coast League.

In professional league competition the team which has the highest percentage at the end of the season is generally accepted as the champion. The percentage is reckoned by dividing the number of games a team has won by the total number of games it has played; the figure is carried out to three decimal places. In some of the minor leagues there is a play-off series among the leading teams to determine the champion. The winners of the major league races play each other for the world championship in what is known as the *world series.* There is also a *little world series* between the champions of the American Association and the International League. In both series the first team to win four games is declared the winner.

In addition to professional players and amateurs, there are a number of players who play professional baseball only on a part-time basis; they are known as semi-professionals. The teams to which they belong are often organized in leagues.

Baseball is more popular in the United States than in any other country. It has also won much favor in Canada, Cuba and Japan. Attempts have been made to introduce the game elsewhere, but without a great deal of success.

Baseball is played on a level stretch of ground. One part of the field, the *diamond,* is laid out in the form of a square; its sides, called base lines, are marked out with lime or powdered chalk at the beginning of each game. Each side of the square is 90 feet long; at each corner there is set a base. Three of these bases, known respectively as first base (or simply first), second base and third base, are white canvas bags, filled with soft material; they are 15 inches square and not less than 3 nor more than 4 inches thick. The other base is called *home plate* (also *home* or the *plate*). It is a five-sided affair of white rubber, set even with the surface of the ground; it measures 17 inches across (see figure 3 for the other dimensions).

THE RUBBER

The *rubber* or *pitcher's plate,* upon which the pitcher must have at least one foot when he throws the ball to the batter, is a slab of whitened rubber set even with the ground; its dimensions are 24 inches by 6 inches. It is 60 feet, 6 inches from home plate, in a line with second base. The rubber is set on an elevation, which must not be more than 15 inches higher than the base lines. The slope from the rubber to the base lines and to home plate is gradual. The term *pitcher's box* is sometimes used as a synonym for rubber; sometimes it is used to indicate the immediate vicinity of the rubber as well as the rubber itself.

For boys under 16 years of age the diamond is rather smaller than the regulation diamond. The distance between the bases is 82 feet and that between home plate and the rubber is 50 feet.

The lines running from home plate to first base and from home plate to third base are prolonged, as you see in figure 2, to form the *foul lines.* These lines, like the base lines, are marked out with lime or powdered chalk. The space between them is called *fair territory;* that outside them, *foul territory.* According to the rule book, the fair territory included in the diamond is the *infield;* the rest of the fair territory is the *outfield.* When one refers to the infield, however, one generally has in mind the territory that infielders cover in handling batted balls.

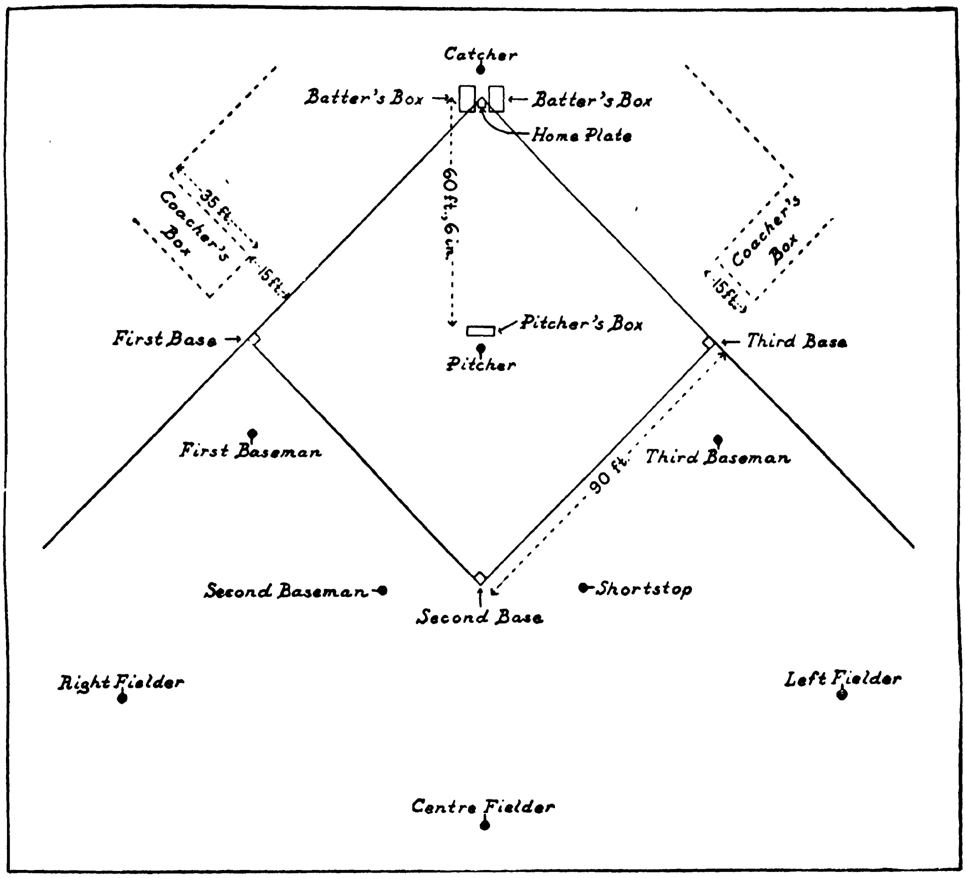
The game is played by two teams, with nine players on each side—the pitcher, the catcher, the first baseman, the second baseman, the shortstop, the third baseman, the left fielder, the centre fielder and the right fielder. The pitcher and the catcher make up the *battery.* The first baseman, second baseman, shortstop and third baseman are the *infielders;* the left fielder, centre fielder and right fielder are the outfielders. When a team is in the field the players take up approximately the posts that are indicated in figure 2. However, the players (with the exception of the pitcher and the catcher) often change their positions when facing certain batters or when certain plays are expected.

BASEBALL EQUIPMENT

Baseball equipment includes baseballs, bats and mitts (or gloves). The catcher is provided, not only with a glove, but also with a mask, inflated chest protector and shinguards. The ball has a cork centre, layers of rubber and yarn and a tightly stretched horsehide cover. The ball weighs between 5 and 5¼ ounces and measures between 9 and 9¼ inches in circumference. The bat is a round wooden club, not longer than 42 inches and not over 2¾ inches in diameter at the thickest part. The mitts of the catcher and first baseman are larger and more heavily padded than those of the other players; these mitts may be of any size. The mitts of the other players must not weigh more than 10 ounces and must not measure more than 14 inches around the palm.

The two teams alternate at bat and in the field. When a team is at bat, each member in turn steps up to the plate with his bat. He stands inside a batter's box (marked out in lime or white chalk), 6 feet by 4 feet in dimension. There are two such boxes, one on either side of the home plate. One box is for right-handed batters, the other for left-handed batters.

The pitcher throws the ball toward the batter; he tries to prevent the latter from hitting it squarely. If he delivers the ball over any part of the home plate, at a height between the knee and the shoulder of the batsman, and the latter does not hit the ball, whether or not he swings at it, a *strike* is called. If the batter strikes at a pitched ball



2. Diagram of the playing field. The little black circles indicate the positions of the players.

without hitting it, a strike is called whether or not the ball has passed over the home plate. If a batter hits the ball outside the foul lines, it is called a *foul ball* or *foul.* If the foul ball is not caught by a fielder, it counts as a strike unless the batter already has two strikes recorded against him; in that case a foul does not count. However, if a catcher catches a *foul tip* (a ball that glances off the bat), it always counts as a strike.

If a pitched ball fails to pass over any part of the plate, or if it passes above the shoulder or below the knee, it counts as a *ball,* provided, of course, that the batter does not swing at it.

When three strikes are called on a batter, he is out. If the catcher drops the ball on a third strike (not in the case of a foul tip, however) and the runner can get to first base before the catcher can get the ball to the fielder at first, the batter is safe at that base.

When four balls are called, the batter is said to receive a *walk* or *pass;* he is permitted to go to first base. He also goes to first unmolested when he is struck by a pitched ball, provided that the official behind the plate is satisfied that the batter tried to get out of the way of the ball. He goes to first, too, if the catcher interferes with him, unless he gets a safe hit despite the interference. A balk is called when the pitcher makes a motion to deliver the ball to the batter, or towards a base-runner at first, and then fails to throw the ball. When this happens, each base-runner advances one base. There can be no balk without a base-runner.

A batted ball hit in fair territory is said to be a *fair ball.* A batted ball is considered fair when (1) it lands on fair territory past first or third base and then rolls into foul territory; (2) it is touched by a defending player in fair territory and then goes past the foul lines; (3) it strikes foul territory and then rolls between home and first base or home and third base (provided that the ball is in fair territory when it stops rolling). If a ball lands on fair ground and then rolls into foul territory between home and first base or home and third base, it is a foul ball, provided that the ball is in foul territory when it comes to rest.

If a batted ball (other than a foul tip) whether fair or foul, is caught by any fielder before it touches the ground, the batter is out. A batted ball that rises in the air to a considerable distance is called a *fly*. If it does not rise very high but *hugs the ground* (that is, keeps fairly close to the ground) in its course, it is called a *line drive* or a *liner*.

When a batter hits a fly in fair territory, he does not wait to see whether or not a fielder will catch it. He throws his bat to one side and he runs to first base. If the fielder drops the ball and fails to get it to a fielder at first base before the batter reaches the base, the batter is safe; the fielder is said to have made an *error* or *misplay*.

GROUNDERS TO THE INFIELD

Sometimes the batter hits a *grounder* or *ground ball* to the infield. This is a line drive that does not rise more than a few feet before it hits the ground. The fielder who is nearest to the ball tries to catch it on the bounce and to throw it to the fielder at first base. If the latter catches the ball and manages to get any part of his body (generally it is his foot) on first base before the runner gets there, the latter is out. If the infielder who first handles the grounder does not catch it fairly on the bounce and fails to catch the runner going to first, or if he throws wildly to first, he is charged with an error. If the fielder at first drops the ball, the error is charged to him.

In most cases, of course, the first baseman handles the ball at first base. Sometimes, however, a grounder is hit at him and he has not time to run over to first base and to tag it; in that case the pitcher takes the throw at first base. As we shall see, the second baseman often covers first base on a sacrifice bunt.

If an error has been made and the batter thinks he can get to second base without being tagged with the ball before reaching the base, he is at liberty to keep on running. If a fielder tags him with the ball before the runner reaches the next base, he is out. If, however, he reaches second base safely, he can try for third base or even for home. When a base-runner reaches home plate safely, he scores a run.

As we have seen, if a runner is on his way to first base after hitting a fair ball, the fielder at first need not touch him with the ball but need only hold the ball while touching the base. At all the other bases, as well as between any two bases, the fielder must touch the runner with the ball, except in the case of force plays and double plays, which we will discuss later.

BASE HITS

A batter may reach first base safely on a *base hit*—a grounder or fly (not caught) to the infield or outfield on which no error is made. If a fielder fumbles a grounder or *muffs* (drops) a fly or line drive which he has no fair chance to handle, the batter is credited with a base hit. If a play is made to some other base than first on a batted ball and all men are safe, the play is called a *fielder's choice;* the batter is not credited with a hit.

If the batter halts at first on a base hit, he is said to have made a *single* or a *one-bagger;* if he makes two bases on the hit, he is credited with a *double* or *two-bagger;* if he makes three bases, he has hit a *triple* or *three-bagger.* If he makes a complete circuit of the bases on the hit, we say that he has made a *home run* or *homer.*

After reaching first, the runner advances to the next base whenever he can do so without being put out. His opponents make every effort to catch him off the base. If the runner is tagged with the ball while not touching the base, he is out. There are several exceptions to the rule. A player on his way to first after hitting a fair ball can overrun the base and then make his way back leisurely without being tagged, provided he makes no effort to proceed to second. A base-runner is not molested when returning to his base after the batter has hit a foul ball that is not caught; also when he advances to the next base as the result of a base on balls or balk or hit batsman. A base-runner is out when struck by a batted ball that goes fair.

Sometimes a base-runner runs to the next base as soon as the pitcher throws the ball. If the batter does not hit the ball, and the catcher cannot get it to the base in time to catch the base-runner, the latter is said to have *stolen a base.*

If the batter hits a fair ball that is not caught, a base-runner on first base must try to reach second, because otherwise first base would be occupied by two runners and one of the two would be declared out. If the ball reaches second base ahead of him, the runner is out. In a case of this sort the fielder at second base does not have to tag the runner; he only has to touch the base. The runner is said to be *forced* at second and the play is called a *force play.* If the fielder at second base, after forcing the runner, can get the ball over to first base before the batter reaches it, the latter is out, too. He is then said to have *hit into a double play.*

FORCE PLAYS

When a grounder is hit with both first and second bases occupied, a force play may be made at second or third bases and the runner at second or first may be doubled. When the bases are full, a force play may be made at any base. Theoretically, it is possible for a batter to hit into a triple play as the result of an infield grounder; this play is rare.

When there is only one runner on base, and he is at either second or third, or when there are two runners on base, at second and third, no force play is possible. The runner may hold his base, if he wishes.

If a batter hits a fly ball (fair or foul), or a liner that is caught, the base-runner must tag his base before he makes any further effort to advance. If, after catching a fly ball, the fielder can get it to the base before the base-runner gets back, the latter is out. The fielder at the base need only touch it; he does not have to tag the runner. If there are two or three men on base, a triple play may result from a fly or a line drive that is caught.

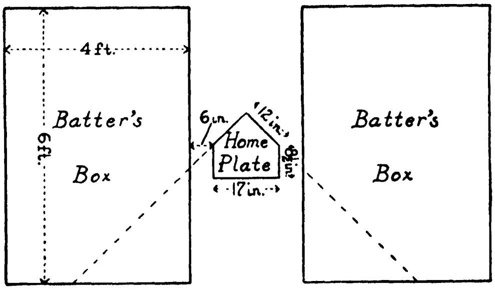
Once the runner has tagged his base after a fly has been caught, he is at liberty to advance to the next base if he thinks that he can reach it before the outfielder's throw. A batter advancing a runner in this way is said to have made a *sacrifice fly.*

If, with first and second, or with first, second and third occupied, and with less than two out, a batter hits a fair fly ball (other than a line drive) that can be handled by an infielder, the batter is out, whether or not the ball is caught. This is called an *infield fly.* The base-runners cannot be forced at the next base, even if the ball is dropped; they are safe if they stay on their bases.

When a man walks with a man on first, or with men on first and second, or with the bases full, all the base-runners advance one base and no play is made on them. Of course, if the bases are full, a run is forced in.

A slow hit tapped in the infield is called a *bunt.* Sometimes the batter deliberately hits a bunt with the idea of advancing one or more base-runners, though he himself will probably be thrown out at first. If he is out at first after advancing the runners, he is said to have made a *sacrifice bunt* or *sacrifice.* On most sacrifice bunts the second baseman takes the throw at first.

From two to four umpires officiate at each game. There are generally three umpires at major league games. One umpire is stationed behind the catcher at home plate; the others take up their posts near the base-lines; their exact positions depend on the plays that are expected. The umpire at the plate is called the umpire-in-chief. He calls balls, strikes and balks and decides when a hit batsman is to be permitted to go to first; he decides whether a batted ball is foul or fair, if there is any dispute in the matter. He also calls all plays at home plate. The other umpires make decisions at the other bases. In world series games four umpires officiate; two are chosen from each league.



3. Diagram showing home plate and batter's box.

The visiting team goes to bat first; when three of its players are out, the visiting team takes the field and the home team comes to bat. When the home team has had three of its men called out, it takes the field again while the other side comes to bat. A period in which each team has had one turn at bat is called an *inning.* Nine innings make up a regulation game; it is won by the team with the largest total score of runs. If the team that first takes the field has made more runs in eight innings than the other side in nine, the second half of the ninth inning is not played.

If the score is tied, as many extra innings are played as are necessary to give one team or the other the lead. In the ninth inning, or in any inning after the ninth, the game comes to an end as soon as the home team has scored enough runs to take the lead. The game may be *called* (that is, stopped by the umpire-in-chief) before nine innings have been played, because of rain, wet grounds, darkness and so on. If at least five innings (or four and a half, if the home team leads) have been played, the game counts; otherwise it does not.

A *time at bat* is generally charged against a player each time that he completes a turn at bat. However, he is not charged with a time at bat if he makes a sacrifice bunt or receives a base on balls or is hit by a pitched ball or goes to first because the pitcher has made a balk. A batted ball that results in a fielder's choice counts as a time at bat. A player's *batting average* is computed by dividing the number of safe hits he has made by the number of times at bat.

TOTAL BASES

To compute a player's total bases in a game, each single that he makes counts as one, each double as two, each triple as three and each home run as four. For example, if a player makes a single, a triple and a home run in a game, we say that he has made three hits for eight total bases.

A batter is given credit for batting in or driving in a run when he causes a team-mate to score as a result of his efforts at bat. A home run counts as a run-batted-in. This means that when a batter hits a homer with the bases full, he is credited with four runs-batted-in. A player batting in seventy-five runs or more in a season is considered outstanding in this respect.

When a fielder catches a fly or tags a runner off the base or touches the base on a runner going to first or on a force play of any sort, he is credited with a *putout*. If a batter strikes out, the putout is credited to the catcher. If a player handles the ball in any play in which the putout is made by another, the first player is credited with an *assist*. We have already explained what an error is. Putouts, assists and errors are added together to make up the *fielding chances* of a player. A player's *fielding average* is computed by adding together the putouts and assists and by dividing the total by the total number of fielding chances.

Perhaps the most important member of the team, at least on defense, is the pitcher. With good pitching, even a mediocre team is hard to beat. Some pitchers overpower the batter by means of blinding speed; others fool him by means of curves. Still others combine fast balls and slow balls in such a way that the batter does not know what to expect; this is called *change of pace*. The most important factor in pitching is *control*—the ability to put the ball just where one wants it to go.

CURVE BALLS

There are various kinds of curves—outcurves, drops, risers, knuckle balls, screw balls and so on. In throwing a curve the pitcher gives the ball a spinning motion at the moment that it leaves his hand. It has been claimed that curves are for the most part optical illusions; that even the sharpest curves break only slightly. Highspeed photographs seem to bear out this viewpoint. However, pitchers who throw curves, catchers who catch them and batters who try to hit them, hotly deny that curves are optical illusions.

Within recent years a variation of baseball, known as *softball*, has become so popular in many parts of the United States that it even rivals baseball itself. In softball, the distance between the bases is 60 feet; that from the pitcher's rubber to the furthest part of home plate is 40 feet. The ball used is larger than a baseball; it is between 11⅞ and 12⅛ inches in circumference and between 6 and 6¾ ounces in weight. The bat is not more than 34 inches long nor more than 2⅛ inches in diameter. Only underhand pitching is permitted. Each team is made up of ten players instead of nine; the extra player, called a shortfielder, is posted back of second base. If a runner tries to steal a base, he must touch the base he occupies until the pitcher actually throws the ball. The regulation game consists of seven innings instead of nine.

Softball, in spite of its rather misleading name, is a strenuous sport, requiring physical fitness as well as skill on the part of the players. A less exacting variation of the game is *slow-pitching softball*. In this game the pitcher must not use too much speed in throwing to the batter. Runners may take a lead off the base before the pitcher actually throws the ball. The baselines are 45 feet long instead of 60; the distance to the pitcher's box is 31½ feet instead of 40.

CHARADES

HERE are some entertaining charades for you to solve. The answers are given on the following page.

You can enter my first at any speed;
When you drive in my second, you must take heed.
If you are dead as my whole, you are dead indeed.

My first is something very bright;
It comes on quickly and then goes out of sight.
It makes my second, which all prowlers fear;
My whole is useless when my second is here.

My first can give you very firm support;
As for my second, it leads all the rest.
To see my third you leave a sheltered port;
My whole you leave to those whom you love best.

My first is a little round ball that people eat;
My second's quite fierce and always loves a fight.
My whole struts up and down on haughty feet;
We must admit, though, he's a gorgeous sight.

To do my first you must take wood in your hand;
My second's to be found in every land.
You may hear my third when you find out the time;
To be my whole, it helps if you can rhyme.

If you lean on my first, you may fall out;
My second is put on bags and trunks and such.
You'll often use my whole, without a doubt,
If you talk little or if you talk much.

To do my first, you must not give up hope;
My second's a cover (not an envelope).
You often use my third as a sturdy brace
When you make a lasting record of a friend or place.

When you're upon my first, you are at sea.
To make my second a pen goes all around.
My third will still your hunger, if need be;
My whole on a brave man's chest is often found.

THE GREAT THOUGHT-READING MYSTERY

"YES, ladies and gentlemen, I will read your thoughts. You will send them to me by thought waves along an electric wire, and I'll read these thought waves as easily as I would a printed book!" So saying, our young magician calls for a volunteer from the audience—a subject who will offer his thoughts to be read by the greatest mind-reader of all time (meaning our magician).

The volunteer is soon forthcoming. The magician now requests him to write on a piece of paper any word, number or sentence that he wishes. Of course, as the magician is a very helpful soul he provides the subject not only with the paper but also with something to serve as a writing pad. The subject now writes the message on the paper and then puts it in his pocket so that the magician will not be able to look at it. Somehow he feels that magicians are not to be trusted!

Next the magician produces some thin wire with a loop at one end. The wire loop is put around the head of the subject. The other end of the wire is placed within easy reach of the magician. The latter now rubs a piece of glass vigorously with a piece of silk in order to charge it with electricity. This will be necessary for the marvelous experiment the audience is about to witness. When the glass has been sufficiently charged with electricity, the magician applies it to his end of the wire.

He now asks the writer of the message to keep repeating to himself the word or words of the message. The audience can almost hear the thought waves humming over the wire. The magician frowns and scowls; he is obviously concentrating. Suddenly he cries: "I have it!" He then repeats the message word for word. The subject is amazed. "Give me the paper on which you have written," says the magician to him; "I want to satisfy myself that I read the message correctly." The subject gives up the paper. The magician reads it; then he says: "Yes, I see now that I was absolutely right."

What is the explanation of this amazing performance? The paper that our young magician uses has been prepared in advance. One side of it has been smeared with ordinary yellow laundry soap. When the magician supplies the subject with the paper, he also supplies him with a writing pad. This happens to be the glass which is used later in the performance. The paper is placed on the glass, smeared side down. As the subject writes on the paper, a thin tracing of soap will be left on the glass. The magician now bids the subject put the paper in his pocket; he himself takes the glass, as he wouldn't think of burdening the subject with it.

Our magician is now going to charge the glass with electricity. Before beginning to rub the glass he slyly reads the message. Then while charging the glass with electricity he is also rubbing out the message. If anybody in the audience wants to see the glass after the message is read, there will be no tell-tale marks of any kind! After the message has been read, the magician, as we have seen, asks the subject to give him the paper on which the message has been written, so that he may test the exactness of his performance. If the subject wants to look at the paper again, the magician will find, to his great regret, that the paper seems to have been mislaid and simply cannot be found. You can easily understand why. If the subject could examine the paper at his leisure, the secret of the trick would be revealed.

SOLUTION OF THE CHARADES ON PAGE 6147

1. Doornail (door-nail). 2. Flashlight (flash-light). 3. Legacy (leg-the letter A-sea). 4. Peacock (pea-cock). 5. Romantic (row-man-tick). 6. Syllable (sill-label). 7. Tripod (try-pod). 8. Decoration (deck-the letter O-ration).

AN ODD METHOD OF MULTIPLYING

THERE is an old saying that all roads lead to Rome—meaning that there are sometimes several ways of doing a thing. For example, if you were asked to multiply 45 by 33, you would undoubtedly go about it as follows:

$$\begin{array}{r} 45 \\ 33 \\ \hline 135 \\ 135 \\ \\ 1485 \end{array}$$

There is another way of producing the same result. Divide a sheet of paper into two columns by drawing a straight line lengthwise down the sheet. Put 45 at the head of the left-hand column and 33 at the head of the right-hand column. Divide the left-hand number by 2 and put down the result, 22 (ignoring the fraction), under the original number, 45. Next multiply the right-hand number, 33, by 2, and put down the result, 66, under the 33. Continue in turn to divide the left-hand number by 2 (always ignoring the fraction, if any) and to multiply the right-hand number by 2. Do so until the left-hand number is 1. As there must be the same number of items in each column, multiply the right-hand number once more by 2 and then draw a horizontal line under both numbers.

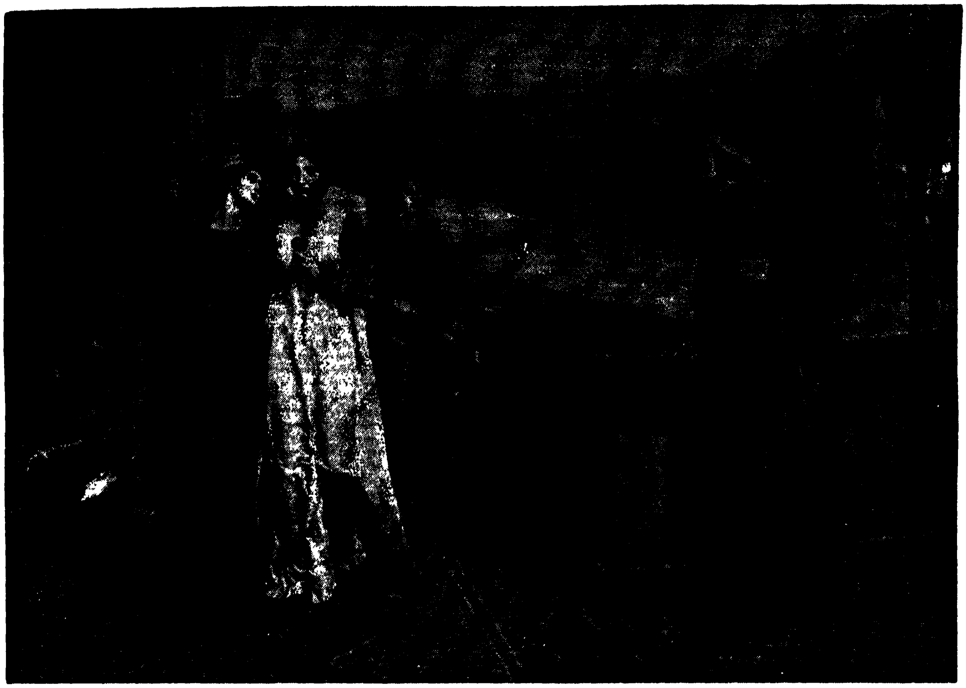
Now put a check-mark opposite the right-hand numbers that come opposite the odd numbers in the left-hand column. Then add together the numbers that you have checked, as follows:

45	33
22	66
11	132
5	264
2	528
1	1056
	1485

The result, as you see, is 1485, which was what we obtained by multiplying 45 and 33 together in the ordinary way. Any two numbers may be substituted for the two that we have given here.

Have a friend write down two numbers in separate columns and then have him go through the processes described above without telling him what the object of all this figuring is. He will be amazed to find out that by means of these calculations he does a simple problem in multiplication.

THE NEXT THINGS TO MAKE AND TO DO ARE ON PAGE 6517



The great Italian poet, Dante Alighieri, beholds Beatrice, the lovely lady who inspired his wonderful writings.

THE LITERATURE *of* ITALY

LATIN, the language spoken by Cicero and Caesar, Ovid and Horace, was also the written language of Italy until about the twelfth century. Men of learning throughout Europe knew Latin well. It was for many years the sole language of the Christian Church, centered in Rome.

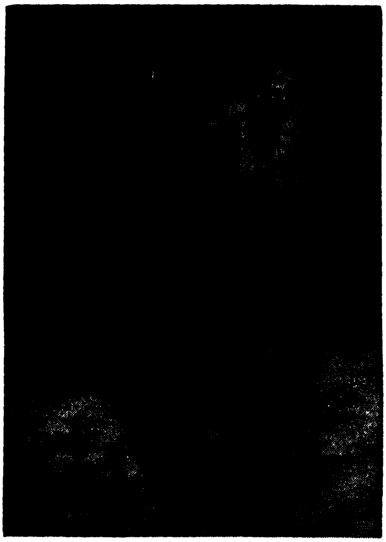
With the passing of time every living language changes. You could not read the English of Chaucer without help; and perhaps not even the English of Shakespeare. As for the ancient Roman tongue, something very astonishing, yet natural enough, happened. It became a dead language. When the great Empire broke up, the spoken language in various parts developed along various different lines. In Gaul (France) several dialects more or less alike became the common speech of different areas, until one stood forth as the favorite of educated people. We call it now Parisian French. But in Brittany and in the south of France and elsewhere, other dialects are still spoken.

The same thing happened to the Latin tongue in Spain. Various dialects grew, and at last one, the dialect of Castile, gained favor among the rulers and the educated people.

French and Spanish and also Portuguese are languages based on the ancient Roman tongue. We call them Romance languages. Italian is another Romance language and it grew in just the way that French and the others grew. Italian was somewhat slower than the others in being accepted as formally correct for literature. The reason is easily understood. The Italian states for hundreds of years were very proud of the past glory of Rome. Italian writers wanted to write in the language made immortal by Vergil and Caesar and Pliny and the many other ancient Roman writers. So—though in everyday speech they used their local dialects—when it came to making books they stayed by the classic Latin.

However, a language that is no longer spoken is a dead language. People gradually lose interest in writing it, and there are few to read it. One, or more, of the Italian dialects was bound to become accepted as a literary language. Let us, then, trace the path of literature's rise in Italy.

The first of the Latin nations to acquire a cultivated literature in the common speech of the people was Provence, a small state between Italy and France. The early poets of Provence, minstrels or troubadors perhaps, exerted in their wanderings a great influence on the neighboring countries of Italy and France. Though the first poetry in Italian was produced in Sicily, it was undoubtedly Provençal in character. By degrees the Provençal stanza or verse form was modified, and a lyrical form developed which, in the sonnet, is one of Italy's most precious gifts to literature.



Southwest Museum

The poet Vergil guides Dante through the Inferno, in Dante's poem of Hell, Purgatory and Heaven, THE DIVINE COMEDY.

By the middle of the thirteenth century there was considerable poetry in the vernacular in Italy, that is, in one or other of the many dialects into which Latin had fallen. The poets wrote in the Tuscan or Sicilian dialect, as it might be. Possibly many of them were ignorant of Latin, which in any case would have been wasted upon the lords and ladies for whom they composed their verses.

It was Dante, and Dante alone, who made Tuscan what Shakespeare called "choice Italian." He gave it a literary value that drew all Italy, though other Italian dialects remain in common use to this day. Interest in Italian writers before and around Dante is confined to their relation to him. He was very generous in acknowledging his debt to his old friend and master, Brunetto Latini, and his admiration of Guido Cavalcanti. Neither of them, however, nor any of the poets who were imitating the songs of Provence, can be said to have equaled his genius. Dante stands as one of the world's supreme poets, mighty in imagination and great in art. He imposed his own conception of the Italian language on Italy.

Dante Alighieri was born in May, 1265, at Florence, of good family. His education was such that he absorbed all the learning of his day, literary and scientific. Italy, and particularly Florence, was then divided between the two factions of the Guelphs and the Ghibellines, with frequently recurring civil war. Dante in his youth was a soldier in these wars, and shared the changeful fortunes of the Guelphs. When they became victorious, and the government of Florence was reorganized, he was, at the age of thirty-five, one of six civil officers, known as priors, who governed the city. But the Guelphs broke up into two parties, the Whites and the Blacks. Dante belonged to the Whites, and in 1302, the Blacks having gained power, the poet was exiled from the city and condemned to be burned alive if he should return.

He never returned, though he often appealed for a reversal of his sentence. Till his death, in 1321, he wandered through the independent cities of Italy, defended by faithful friends. Sometimes he went from city to city on business and it was while traveling between Venice and Ravenna that he caught fever and soon died.

Dante, though living thus in exile for twenty years because of false charges, was known everywhere as a notable man—a scholar, philosopher and statesman, as well as a poet. In an age of violence and prejudice he had far-reaching thought. His ideal was to bring all Italy, and preferably all the world, under one temporal and one spiritual ruler who together might rule all men in peace. The ruler was the emperor, the spiritual leader was the pope. This was his remedy for the wars that cursed the world under many ambitious rulers. But the great union of peoples never came near fulfillment, and it is as a poet that his name is immortal.

Dante stands in history between two great ages. Behind him was the medieval world, with the ancient world of Rome and Greece behind that. Before him was the dawn of the modern world. In his greatest poem, THE DIVINE COMEDY, he pictures for all succeeding time the medieval world he knew, but his mind was open to the influences of the freedom that was coming.

His first poem had been on the subject

which all poets of his time made their chief theme—love. When he was quite a child he admired greatly a girl named Beatrice Portinari, whom he met at the house of her father, Folco. In his own words, "already nine times after my birth the light of heaven had returned, as it were, to the same point, when there appeared to my eyes the glorious lady of my mind, who was by many called Beatrice. Her dress on that day was of a most noble color, a subdued and goodly crimson, girdled and adorned in such sort as best suited with her tender age. At that moment I saw most truly that the spirit of life which hath its dwelling in the secretest chamber of the heart began to tremble so violently that the least pulses of my body shook therewith. . . ."

TO DANTE, BEATRICE WAS INSPIRATION AND THE IDEAL OF WOMANHOOD

It is doubtful whether he spoke to Beatrice more than once, but she lived long in his heart as the symbol of woman's beauty and purity. She married someone else and died young. To him she was the ideal woman, and in his work *Vita Nuova,* or NEW LIFE, he told the story of his love for his ideal of womanhood. The book was written before the chief troubles of the poet's life began.

His DIVINE COMEDY was written—we do not know where or when—during the twenty years of his wandering exile. It is a picture of the future life of man as it was conceived in the Middle Ages.

The poet imagines himself conducted through Hell, through Purgatory and through Paradise. In these places he sees men and women being dealt with hereafter according to the things done by them in the body, whether they were good or evil. Many of the souls kept either in hopeless torture, or under purifying fire, or raised to heavenly places, were people who had been known to him during the changes of his harassed life.

VERGIL AND BEATRICE ACT AS GUIDES IN DANTE'S DIVINE COMEDY

Like Spenser's FAERIE QUEENE the poem is full of hidden meanings, but it may also be read naturally. The poet pictures himself as lost in a forest, symbolizing this world's cares. He is met by the poet Vergil, who conducts him through the lower regions, where the vicious are punished; then upward through the seven terraces of Purgatory, where suffering is not hopeless. Finally he meets Beatrice, who is his guide through Paradise, where at last he has a momentary veiled vision of God, as his own will is entirely surrendered to the Divine purpose.

The following extracts are taken from the opening cantos of the INFERNO (Hell). We find the poet lost amid the cares of this world, which are symbolized by a gloomy wood:

In the midway of this our mortal life,
I found me in a gloomy wood, astray,
Gone from the path direct: and e'en to tell,
It were no easy task, how savage wild
That forest, how robust and rough its growth,
Which to remember only, my dismay
Renews, in bitterness not far from death.
Yet, to discourse of what there good befell,
All else will I relate discovered there.

No sooner does he escape by climbing a mountain than he meets with various wild beasts—a panther and a lion and a she-wolf—and turning from them with terror, he discovers Vergil.

While to the lower space with backward step
I fell, my ken discerned the form of one
Whose voice seemed faint through long disuse of speech
When him in that great desert I espied,
"Have mercy on me," cried I out aloud,
"Spirit, or living man! whate'er thou be."
He answered: "Now not man, man once I was,
And born of Lombard parents, Mantuans both
By country, when the power of Julius yet
Was scarcely firm. At Rome my life was passed,
Beneath the mild Augustus, in the time
Of fabled deities and false. A bard
Was I, and made Anchises' upright son
The subject of my song, who came from Troy,
When the flames preyed on Ilium's haughty towers.
But thou, say wherefore to such perils past
Return'st thou? wherefore not this pleasant mount
Ascendest, cause and source of all delight?"
"And art thou then that Vergil, that well-spring
From which such copious floods of eloquence
Have issued?" I with front abashed replied.

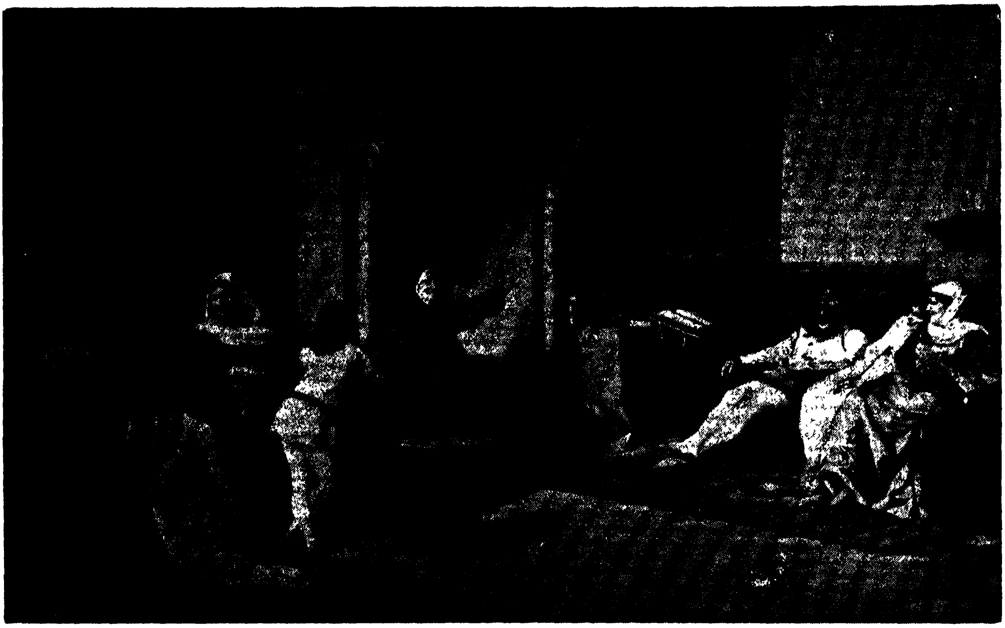
Vergil offers to guide him through the lower world,

Where thou shalt hear despairing shrieks, and see
Spirits of old tormented, who invoke
A second death;

and thence to direct him to the terraces of Purgatory and

Those next view, who dwell
Content in fire, for that they hope to come,
Whene'er the time may be, among the blest,
Into whose regions, if thou then desire
To ascend, a spirit worthier than I
Must lead thee, in whose charge, when I depart,
Thou shalt be left.

Dante's INFERNO is in shape an inverted cone, divided into seven circles. Each circle



Gramstorff Bros., Inc.

Together with Dante and Petrarch, Giovanni Boccaccio is one of the great names in Italian literature. He was a wonderful teller of tales, and wrote poetry, novels and short stories, such as those in his famous DECAMERON.

contains a different class of sinner who is more wicked and receives worse punishment as the circles get lower and narrower. The guilty are assigned to their punishment by the great hound Minos. He,

Grinning with ghastly feature: he, of all
Who enter, strict examining the crimes,
Gives sentence, and dismisses them beneath,
According as he foldeth him around:
For when before him comes the ill-fated soul,
It all confesses; and that judge severe
Of sins, considering what place in hell
Suits the transgression, with his tail so oft
Himself encircles, as degrees beneath
He dooms it to descend. Before him stand
Always a numerous throng; and in his turn
Each one to judgment passing, speaks, and hears
His fate, thence downward to his dwelling hurled.

We can not follow the two in their descent, nor Dante's later ascent of the mount of Purgatory and journey through Paradise. You will come to read these for yourselves. There have, of course, been many translations of the DIVINE COMEDY (Dante did not use the first word in his naming of his poem: it was added later). Of the translations into English, perhaps the best is Cary's. Gustave Doré illustrated it with some wonderful drawings.

Dante's imagination reaches a majesty unsurpassed. Milton is the only other poet who dared to attempt a theme so lofty, and with Milton, Shakespeare and Homer, Dante ranks among the world's supreme poets.

"In the year 1304, on the very day when Dante and his exiled companions were making their desperate attempt to fight their way back into Florence, Francesco Petrarca, the child of one of their number, was born in the Tuscan town of Arezza. Six years after Dante's death a casual encounter with a lady who awoke the faculty of song within him made the scholar the first poet of the age." The passage is taken from Garnett's HISTORY OF ITALIAN LITERATURE.

Petrarch was educated at Carpentras, at Montpellier and at the University of Bologna. His father's wish made him study law, but after the death of his parents he devoted himself entirely to literature. On April 6, 1327, occurred the great event of his life—his vision of Laura in church "at the hour of prime"—which made him a poet. His reputation grew rapidly, and his verse made him and Laura famous all over Italy. Petrarch brought glory to his country by the beauty of his writings.

In 1348 a great plague, the Black Death, swept his inspiration away. Laura died on the anniversary of her meeting with the poet-lover, April 6. Petrarch remained constant to her memory, and though his life continued active in diplomacy and his interests in literature very broad, his poetry kept to the single theme.

It is for his poetry that Petrarch is justly celebrated. The love sonnets contained in his CANZONIERE are in two parts. The first book comprises the pieces before Laura's death, the second, those composed afterward.

He felt himself ennobled by his love.

Now with such beam and such direction blest
'Twere shameful in brief way to miss the sign
Pointing the passage to eternal rest.
Upward, faint soul, thy heavenward path incline;
Through clouds of her sweet wrath pursue thy
quest,
Following the seemly step and ray divine.

When bereft of that love he felt all his purpose gone:

Dried is the ancient fountain of my wit
And all my music melted into tears.

Petrarch died in 1374.

Another writer of the period, Giovanni Boccaccio, was Petrarch's friend. Boccaccio speaks of himself as "of Certaldo," a small Tuscan town where he held some property, but he was probably born in Florence in 1313. His father, a Florentine merchant, brought him up to be a trader, but when Giovanni showed great distaste for this, made him study law at the University of Naples. Here the boy sowed his wild oats until he was recalled to Florence by his father, who died in the same pestilence as that which carried off Petrarch's Laura.

Boccaccio was an enthusiastic admirer of Dante and delivered public lectures on him. He rightly believed Dante's DIVINE COMEDY to be supreme in what was then modern literature. He himself may be called the first modern novelist, the "father of Italian prose."

The FILOCOPO, his first and longest work of fiction, would be very tedious reading today, but it is important as marking a stepping-stone from the old metrical romances to the pure novel in prose. For its own day it was an epoch-making work, and it had a great influence on succeeding writers. His AMETO was also important as being the first example of the pastoral romance, and of the weaving of several stories into one.

Boccaccio's abiding fame rests on his collection of prose tales, the DECAMERON. As a framework for this book he imagines the people fleeing from the plague in Florence in the year 1348 and passing the time by telling tales in a garden outside the city. The tales, many of them old, are gathered from all kinds of sources, and a number of them offend our taste today. However, they are told by Boccaccio with fine skill, and they served as a store of fiction for novels and

JERUSALEM DELIVERED is an epic poem of the Crusades and one of the masterpieces of Italian literature. Its author was the poet Torquato Tasso, who is pictured here reading some of his works to ladies of the Este family.

plays for several centuries. The framework of the book, the scene of the story-telling, its groves and orchards, fountains and gardens and charming company, are almost more delightful than the stories themselves. In style Boccaccio showed himself the model of later story-tellers, none of whom was ever able to surpass him on his own ground of easy simplicity.

The fifteenth century was very barren in Italian literature. There were, besides, no fine statesmen or warriors of real greatness. The age seemed to have lost its intellectual vitality, though in art there was a rapid development of pictorial and plastic work, and a renovation of architecture. The old universities were improved, and private societies of scholars were formed—two achieving special celebrity, the Roman Academy, and the Platonic Academy at Florence.

Nevertheless the classic tongues, Latin and Greek, were absorbing a great part of men's notice. The Renaissance, or Revival of Learning, heralded by Petrarch and Boccaccio, became all-important in the latter part of the century. The Turks captured Constantinople in 1453, and the exiled Greek teachers and men of letters came to the Italian universities, bringing with them what precious manuscripts they could salvage. Learned Italians caught the fever and began collecting, translating and imitating at a feverish pace. The recent invention of the printing-press spread this knowledge of the literature of ancient Greece and Rome through the length and breadth of the land, and ultimately throughout the whole West. Florence was to the fore in this movement, but other important centers such as Naples, Ferrara, Rome, Mantua, Venice, Bologna and Milan were very active.

But the Latin writing did not help Italian. Count Matteo Boiardo, in his ORLANDO INNAMORATO, reproduced the Charlemagne romance which forty years later Ludovico Ariosto continued in his ORLANDO FURIOSO with amazing spirit. Boiardo lived from 1434 to 1494. Ariosto lived from 1474 to 1533. The French form of Orlando is Roland. This was the name of the hero in the French epic, THE SONG OF ROLAND.

In the sixteenth century Torquato Tasso, (1544-95) son of a poet of some distinction, produced in *La Gerusalemme Liberata,* or JERUSALEM DELIVERED, an epic of the Crusades, the first of Italy's heroic poems. He had previously written, when quite a youth, a graceful romantic poem, RINALDO, and an exquisite pastoral, AMINTA. Tasso unfortunately was too sensitive to criticism: he allowed his detractors to prey on his mind until at intervals he lost his reason. His poems, however, have retained immense popularity in Italy, and he is in the line of great Italian poets, and brings the line to a close.

Underwood & Underwood

Gabriele d'Annunzio was novelist, poet and playwright, as well as adventurer. His exploits during and after World War I made him a national figure in Italy.

Among Italian writers who were distinguished in prose were some whose fame is not chiefly dependent on their writing: the immortal artists, Leonardo da Vinci and Michelangelo; the scientists, Bruno and Galileo; and the philosopher, Tommaso Campanella, whose ideal CITY OF THE SUN is still read in English. All were masters of a vigorous prose style.

In the eighteenth century Carlo Goldoni and Vittorio Alfieri brought new life to Italian drama. Alessandro Manzoni, the historical novelist, and the poet Leopardi, are outstanding names in nineteenth century literature, and the political idealist, Mazzini, wrote eloquent prose.

The psychological dramas of Luigi Pirandello (1867-1936), among them especially SIX CHARACTERS IN SEARCH OF AN AUTHOR, AS YOU DESIRE ME and THE LIVING MASK, are well known to us in translation. Both in his plays and in such novels as OUTCAST and THE LATE MATTIA PASCAL, Pirandello showed great originality and penetration.

Grazia Deledda (1875-1936) wrote novels about her native Sardinia. One of them, THE MOTHER, was called by Pirandello the greatest story written in Italy in recent times. In 1926 she was awarded the Nobel Prize for literature.

Gabriele d'Annunzio, who died in 1937, was a lyrical poet with imagination and power, but his brilliant dramas lacked the humanity that gives a work of art lasting appeal. Other important figures in modern Italian literature have been Benedetto Croce (1866-), Vilfredo Pareto (1848-1923), Guglielmo Ferrero (1871-1942), Giovanni Papini (1881-), and the novelist Ignazio Silone (1900-).

THE NEXT STORY OF LITERATURE IS ON PAGE 6265.

Antwerp Cathedral.

THE GOLDEN YEARS IN EUROPE

THE growth of Northern Europe during the Gothic centuries—the twelfth to the fifteenth—makes a most interesting story. But if we said, after a summary of the ringing years wherein whole kingdoms changed hands and new ideas rose in men's minds, that "a number of cathedrals were also set up," we should be putting the case wrongly.

Unhappily, a number of the buildings which are mentioned in this article are either in ruins or gravely damaged as a result of World War II. But we shall speak of them here as they once were in all their glory.

The first group of these great buildings was due to an extraordinary wave of creative energy and zeal that overran northern France in the twelfth and early part of the thirteenth centuries. It lasted for about two generations, and was something like a religious revival whose expression was rather in setting up houses of God than in saving souls. It is difficult for us, a more developed nation, with our growing years almost forgotten, and, moreover—regretfully we must say it—living in an age when useful and money-making things are most important, to understand that fine flowering of the youth of the French nation.

The grand old abbey churches of Romanesque times had been built by monks and belonged to the monasteries. As the various states of France were being drawn into one kingdom, with Paris becoming more and more the centre of government, a new spirit arose and a new power—the power and the spirit of people united in the interests of their towns.

Each town, it seemed, cried out for a cathedral. Some one of the northern architects—no one will ever know at what minute in time's history or in what place in France the door opened on Gothic architecture—someone had somewhere found that the pointed arch could be flung up to any height, and that roofs set on intersecting pointed arches or vaults could soar like clouds above the plain.

This new kind of architecture exactly suited the ardent, adventurous people of young France. The men of a town said: "We must have a cathedral. And we do not mind if some people say that buildings of the new kind will totter and fall. We will take the risk. And our cathedral shall be the loveliest in France."

An architect was summoned, and all

he had to do was to build and to master constructive problems. There was none of that tiresome estimating of costs to be thought of; the people saw to that. Stone in plenty, of a fine quality, was there to be quarried. Those who could not give money gave labor. "Whenever the great blocks of stone were hauled up by cables from the quarry, the people of the district, and even those of the neighboring regions, nobles and commons alike, harnessed themselves to the ropes by arms, breasts and shoulders, and drew the load like beasts of burden."

In such a spirit did these first Gothic cathedrals rise on the barren shore of French towns. A flame of ardor so generous must needs burn itself out. A century after these people prayed among their stones, cathedrals were set up by men who were summoned to work; some of them were built by forced labor.

But in the meantime, while their first cathedrals were building, the townsfolk watched eagerly for such part as might be finished in their own lifetime. Additions were made later—an extended choir here, a chapel, a transept, there. The decorating with sculpture kept hundreds of people eager and happy. But as soon as the bones of the cathedral were put together, so to speak, as soon as the house of God had roofs and walls, doors and an altar, it was opened with joy unspeakable. The townsfolk remembered to their dying day the first time praises were sung under those great echoing arches, which seemed themselves to hold up their pointed hands to pray, to catch the benediction and toss it down again to the crowds, tiny and awestricken, in the nave.

THE STORY OF THE BIBLE IN THE WINDOWS OF OUR CATHEDRALS

To the people, unlettered, superstitious, their cathedrals were more than the centre of town life, their pride and joy, the thing that they had made. They were like huge religious story-books which the most ignorant could read. On the outside of the fabric they could see numberless figures of saints and holy persons, and learn from their attitudes and their emblems something of the reward of goodness. There were also figures of less happy individuals to whom a just punishment had been meted out.

Inside the buildings the lovely golden light of stained glass drew their eyes; and there, rank upon rank, was painted the heavenly company. The whole story of the Bible gleamed out as men passed from window to window.

No peasant ever forgot the Old Testament tales and the Gospel lore learned from the cathedral pictures, and you may be sure that boys and girls growing up in those days were quite clear about the doom that lay in wait for the wicked, and the reward of piety. They were as sure on that point as they were about the number of pinnacles and decorations added to the cathedral since they themselves were three or four. They listened, grouped round the skirts of their elders in the Place, or Cathedral Square, to rare travelers who had come in from one of the highways of Europe and had met with many adventures and had seen great abbeys and churches. But the little ones stared up at their own buildings and felt no other could be so fine.

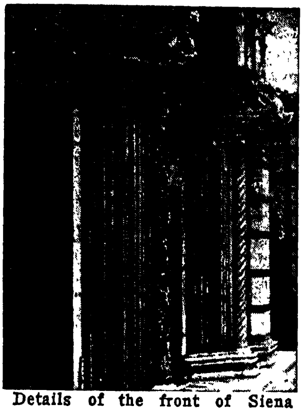
THE CHANGE WHICH CAME OVER THE OLD CHURCH OF ST. DENIS

While in various places in northern France these monuments of the new art were rising, some very memorable work was being done in Paris, both in the precincts of the old Romanesque abbey of St. Denis and in the cathedral of Paris, known all over the world as Notre Dame. In the hands of the builders St. Denis slowly changed from Romanesque to Gothic form. Its Gothic was very simple, as nearly akin to Romanesque as two different styles could be. We are very thankful that the lovely old Romanesque crypt was left, with its pure round arches.

One of the grudges we have against Gothic builders was their inability to let well enough alone. They had wonderful ideals for new buildings; it was a pity they thought that nothing which was not in accord with their new ideals was fit to exist. Therefore they unfeelingly pulled down the Romanesque churches, sometimes to use stone for the new buildings, sometimes because they were weak and needed strengthening, sometimes out of sheer contempt for them. The result is that only here and there can we find the work of some of the earliest Christian builders of Europe. But this scant reverence for the work of yesterday is a human trait which we are constantly meeting to-day.

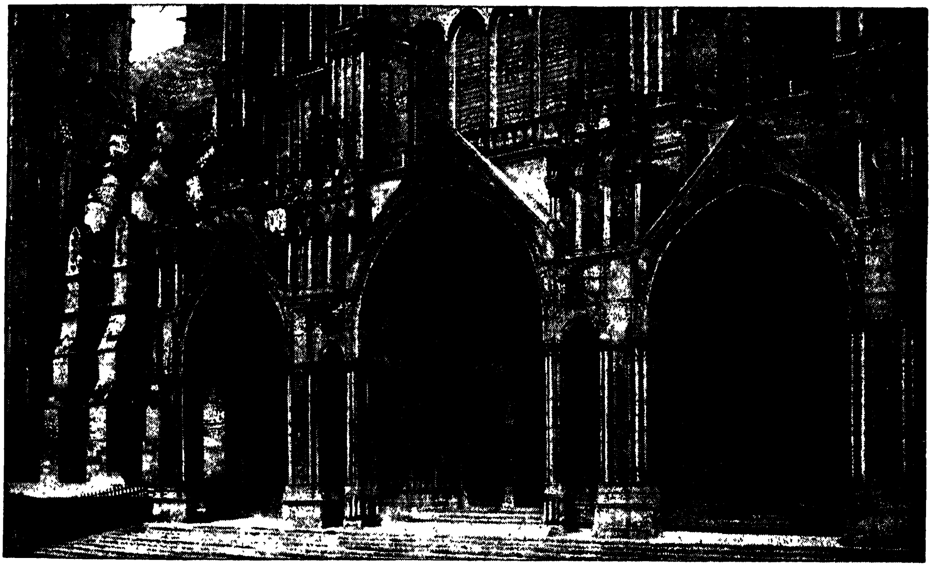
In 1163, very soon after the Gothic choir was consecrated in the abbey church

The nave and choir of Antwerp Cathedral.

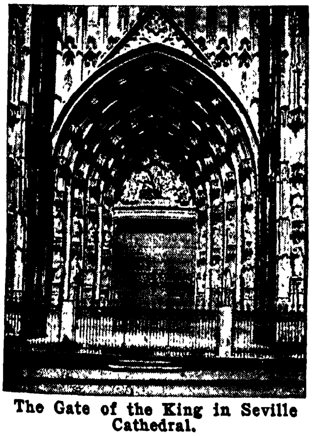


Details of the front of Siena Cathedral.

The choir and organ in the Great Church, Haarlem.

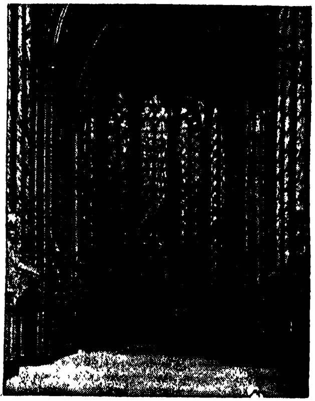


The south entrance to Chartres Cathedral.



The Gate of the King in Seville Cathedral.

The ambulatory in Chartres Cathedral.



The lovely windows of Sainte Chapelle in Paris.

of St. Denis, the foundation stones of Notre Dame were laid. The building of this cathedral covered about a hundred years. It was begun under Maurice de Sully and shows something of the simplicity of the Gothic work in St. Denis. It is sturdy, like the Romanesque, as if builders had still not forgotten, in spite of themselves, the beliefs of their old faith. They were afraid to fling their arches too high. They set them on enormous pillars, carried them up to the blindstory, rested in solid masonry, then threw up more arches, rested again, and finally reached the vault lines.

This early vigor has happily not been lost in succeeding generations, nor at the hands of numerous restorers who worked on Notre Dame in the nineteenth century. The foundation of the cathedral strikes into the roots of a very old Europe. It was built on the site of a heathen shrine which in the fourth century became a Christian altar.

The façade, or chief front of Notre Dame, is one of the nobiest productions of early Gothic art. It has the same solidity and clearness of arrangement that marks its interior. Romanesque architects, we know, had derived much of their art from classical buildings; these, in turn, had sprung from Greek architecture, which was so measured and well-proportioned that if one saw only the base of a column one would know the proportions of the whole building.

THE SEVERITY AND SIMPLICITY WHICH GIVE CHARM TO NOTRE DAME

From this rigorous pattern Gothic architecture was destined to take a very wide leap. As we noted in our talk on English Gothic, no two cathedrals are exactly on the same plan or proportion. It happened sometimes that two resembled each other; but, generally speaking, from the end of the first period each Gothic building was a separate adventure.

The façade of Notre Dame is in form nearly a pure letter H. Its severity and simplicity have great charm. We feel very glad that the twin towers which finish off that part of the roof covering the side aisles have never, in the fever of a later period, been decorated or added to. They are just right; the architect who ended the towers in that uncompromising horizontal line had very fine taste. The apse was thrown out, chevet form, a French characteristic we have already noted, with very strong flying buttresses. At a later period the spaces between these buttresses were used for the building of little chapels.

The cathedrals of Lens, Laon, Senlis, Noyon, Soissons, all begun about the middle of the twelfth century, have something of the simplicity of Notre Dame, Paris. They mark that period of early French Gothic which is generally called Lancet, and which ends about the close of the twelfth century. The windows of buildings of this style are pointed, with simple geometric tracery.

The work of the thirteenth century, marked by a development in height and general grandeur, was called Rayonnant. This name was taken from the huge circular windows with wheel-like traceries that marked the cathedrals of the period. In the fourteenth and fifteenth centuries Flamboyant Gothic ran its course in France, characterized by the flame-like, wispy traceries of the windows.

THE WONDERFUL CATHEDRAL AT BEAUVAIS, WHICH IS STILL UNFINISHED

It seemed that when the early twelfth-century cathedrals were in course of construction, architects began to think how much further they could go on the same lines, developing the Gothic idea. They began to have a yearning for tremendous height in the naves and choirs. In some cases, like that of Beauvais, the builders were too daring: their choir just dropped in. The choir was restored, but the cathedral remains unfinished to this day, is but a glorious fragment consisting of a choir and a transept. It has, nevertheless, a very wonderful south doorway, with a great rose window, and the carved doors are a miracle of beauty. They are by Jean le Pot, of Beauvais, and some think they are the finest doors in the world.

The makers of the cathedral of Chartres, begun in 1194 and completed before 1240, succeeded in setting up a very lofty building on more sturdy lines. The nave is an interesting development from that of Notre Dame, but the outside gives an effect of rather rugged strength: there are too many buttresses.

From the façade of the cathedral we can see at a glance that the building was begun in Romanesque times. Curiously, over its round-headed porches is set the wheel window of Rayonnant Gothic. At a later period the Romanesque towers were carried up into Gothic spires. The north and south porches of Chartres are among the finest pieces of Gothic.

WHY GOTHIC IS CALLED A "RESTLESS" STYLE OF ARCHITECTURE

Bourges Cathedral, remarkable for its heavily sculptured façade with five doorways flanking each other, is a development of another kind. There are no transepts, and thus the building makes a long unbroken line. In Le Mans Cathedral the architect seemed to think more of the chancel than the rest of the church. It has double aisles, and from them open out thirteen chapels; so that inside, the eye can find no rest, no final lines, and outside, the body of the church seems dwarfed behind the monstrous flying buttresses and the projecting chapels.

We need only look at a photograph of the apse of Le Mans Cathedral to see all that Gothic architecture might be and all that it is not. And we can quite understand, if we have not already done so, why it is called a "restless" architecture.

In the nave of Amiens Cathedral, which is one of the loveliest in France, the architect succeeded in realizing his dream of height. It is a very wonderful feat of constructional skill, with scarcely a line to break the soaring pillars and arches. When we look at it we can understand why at one period the ignorant folk of France, terrified at such audacity in the way of building, made up stories about the architects, who, they said, were in league with the Evil One and had sold their souls as a price for their cathedrals' amazing height and slenderly balanced interiors.

THE GENIUS OF THE SCULPTOR IN THE FAÇADE OF RHEIMS CATHEDRAL

The Cathedral of Notre Dame at Rheims, for so long the coronation church of French kings, is one of the most powerful productions of medieval Europe. It has a huge broad nave, where immense crowds could gather on great days. It was planned more or less on the lines of Notre Dame, and its façade somewhat resembles the Paris cathedral. But Rheims grew up, so to speak, in the more florid days of French Gothic, and the simple grandeur of its structure is hidden.

Although each cathedral was different from the others, there was a certain unity in the work of the architects of northern France. Some façades are more gorgeous in adornments than others. The front of Rheims is one great glory of the sculptor's genius in those days, and its pillared, bodiless towers and dainty wheel window give an ethereal look to a very powerful structure. In other façades, notably that of Bourges, the sculpture clings round the great doorways, and the upper part is barer. In several cathedrals a curious look is given to the façade by the towers of different periods and varying form and height that adorn the same building. Rouen Cathedral looks, from the front view, as if all its parts do not belong.

As we noted in our study of English Gothic, the French cathedrals were generally carried so high that they could not support the weight of a tower at the crossing of the nave and transepts, as in the case of the British cathedrals. Sometimes they had a short spire—the highest is the slender shaft of Amiens, added in the early sixteenth century. In some of the churches of Normandy, which were nearest akin to the English, there were central towers, like the one in Rouen Cathedral. For the most part French architects concentrated their interest in towers and spires to the chief front of the cathedral.

THE BEAUTIFUL LITTLE CHURCHES IN THE TOWNS OF FRANCE

The Norman buildings strike a severer note than those in the rest of northern France. At Coutances, Bayeux, Mont St. Michel, on the Brittany border, at Quimper, churches and cathedrals are marked by plainer, more soaring lines. Mont St. Michel is especially famous for its magnificent monastery buildings set within its fortress-like walls. In a great many towns of France smaller churches appeared, some of great beauty. The finest of them all is the Sainte Chapelle of St. Louis in Paris.

In northern France, the cradle of Gothic architecture, the new art grew and expanded, changed its form, was enriched and made complex as the taste of its builders dictated. It had next to no opposition in the way of established architecture. As we go south we see a curious change. The Loire was the northern boundary of the stronghold of Romanesque art, and here pure Gothic has not complete sway. Indeed, faced by that glory, the abbey church at Cluny, one wonders that the people of southern France tolerated Gothic at all.

The cathedrals and churches that were set up south of the Loire were a compound of Gothic and Romanesque. The most famous are the cathedrals of Albi and Carcassonne. Poitiers Cathedral is an interesting specimen of Gothic-Romanesque; that of Bordeaux shows more Gothic than any other—one of the few cathedrals with flying buttresses in the south of France.

THE UNFINISHED CATHEDRALS WHICH WERE STARTED CENTURIES AGO

Bayonne Cathedral, built in part on the ruins of an earlier structure, and still unfinished, shows some northern Gothic work, and has the remains of a fine thirteenth-century cloister. The cathedral of Toulouse is a strangely-put-together church, and this also is unfinished, though the nave dates from the same period as the Bayonne cloisters. But, however skillfully finished, it can never have the same merit as St. Sernin's, the Romanesque church in the same historic old town, built and finished and its period rounded up before the Gothic cathedral, St. Stephen's, was thought of. Rodez is another wonderful church of the south, its naked-looking walls making a kind of huge pillar support for the sculptured towers of various periods surmounting it.

The farther south one goes, the plainer, more restful is the architecture. The builders disliked flying buttresses and disliked the idea of the nave's being so much higher than the side aisles. They therefore carried the aisles up almost the height of the whole building, and broke their walls with long, slender windows. The roofs were almost flat, and generally beautifully finished with parapets and small pinnacles; there was often a simple tower reminding one of the campanile of the earlier century. The result was a mixture of dignity and severity. Albi Cathedral is called a fortress church.

THE SOMETHING HUMAN AND VERY CHILDLIKE IN FRENCH GENIUS

When the last phase of Gothic architecture appeared, it pleased one of their builders to add to this grand, majestic old church at Albi a most delicate Gothic porch, full of dainty lines and the chasings of the Flamboyant period.

There was always something very human, and a little childlike, in the French Gothic genius. When once its first spiritual ardor was sped, when it no longer flung itself skyward, it wandered about very happily, making beautiful things. And it seemed that no later architect could view the work of an earlier generation without wanting to make his mark on it too.

By its nature it was an elastic art. There could always be another chapel added to a cathedral, another set of pinnacles, or a doorway, with its scope for limitless sculpturing; or the head of a tower could be taken off and its body carried higher, or another tower added.

Before the end of the fifteenth century architects seemed no longer capable of the long "drive" necessary for setting up a big cathedral or church. They were content to work, in unending elaborations, on a piece of one. They were so engrossed in making a porch or a tower look like lacework that a building as a huge scheme became impossible to them.

THE TREASURE-HOUSES OF THE ART OF THREE RICH CENTURIES

This same decorative, rather than constructional, skill had always found scope in the interiors. Long books could be written about French cathedrals without once mentioning structure of walls and roofs and the problems of architecture. They became treasure-houses of the art of three rich centuries. Their little and big images and statues, their tombs, their rood screens, grills, and beautiful doors with wrought hinges, their chancel stalls and bishop's thrones, their altars and side altars—on all these a minute and wonderful skill spent itself.

Gothic art ran its course throughout civilized Europe—in Spain, Italy, Germany, the Netherlands, Austria; it touched Sweden and Hungary; but nowhere had it such a magnificent development as in France and England.

Strasbourg, one of the finest of the French cathedrals, was built in the second half of the thirteenth century and added to in later periods. Its erection coincided with the rise of Gothic architecture in Germany. Thus, a hundred very wonderful years had sped after the beginning of Notre Dame before churches in the new style were set up east of the Rhine. Romanesque architecture had a hold there, and Gothic was not welcomed.

For a long time buildings were a mixture of the two styles. Limburg Cathedral and the Liebfrauenkirche, Trèves, are fine specimens of the work that was done in the transition from Romanesque to Gothic. The most interesting church of the two styles is St. Gereon, Cologne, built on an ancient round tomb-house.

THE STYLE THE GERMAN PEOPLE LIKED IN THEIR CHURCHES

The German people kept their love for the many-apsed churches, and they also, in some cases, adopted the French style of the chevet. Like the southern French, they often preferred aisles and nave of the same height, and consequently many of their churches have no clerestory and no blindstory, and are of the type known as the "hall" church. This type of design is very grand internally, owing to the vast height of piers and arches. But the nave is generally not well lighted.

The grand western façades so usual to French Gothic never became a feature of German cathedrals and churches. Their porches are often set north or south and are rarely imposing.

North of Berlin the plain of Europe has no stone, and medieval architects, always availing themselves of the natural material of the district, built here almost entirely in brick. Germany's collection of medieval brick buildings is unequaled.

St. Elizabeth, Warburg, built in the thirteenth century, is an excellent example of the hall church with many apses. The Frauenkirche, Nuremberg, built a century later, was a fine old hall church with a quaint two-storied porch, in which was set the famous clock that started the figures of the seven Electors in movement about the king when the noon hour struck. Munich Cathedral is also of this hall type, and many churches, like St. Lambert, Hildesheim, and St. Stephen, Vienna, which was badly damaged in the war.

THE BEAUTIFUL GERMAN CATHEDRAL BUILT IN THE FRENCH GOTHIC STYLE

The cathedrals of Freiburg, Regensburg and Ulm were all built in the thirteenth and fourteenth centuries and added to later.

Cologne Cathedral is the finest example of French Gothic in Germany, and it is the largest cathedral in Northern Europe. It is imposing, but not great because its proportions are wrong. The French Gothic builders know by instinct how wide a church should be in relation to its length, and just how much weight should go into the transepts and aisles. Here the German architects, building in the French style, were at fault.

They made their double side aisles as wide as the nave, so that the cathedral has far too much width to carry for its length. They also made their twin towers too huge and too high, five hundred feet, so that they overbalance the rest of the building. And in the decoration of the towers their artistry was at fault. They lacked the dainty ingeniousness of the French sculptor.

The secret of the failure of Cologne Cathedral, imposing as it may be, is that it was built by a people to whom Gothic architecture did not really appeal. They obeyed its rules, but knew not its spirit. Their art did not express itself in that way. To them Gothic architecture was a music for which they had no ear.

The technique of their workmanship was excellent. As craftsmen they were hard to beat. They must have carved lovingly their woodwork and stonework, so closely imitative of nature's form. But they lacked the free fling of the Frenchman's chisel.

THE GERMAN FEELING EXPRESSED IN THE CHURCHES OF THE LOW COUNTRIES

The feeling for width that marked the German churches, particularly Cologne Cathedral, was shared in the Low Countries. Antwerp Cathedral, the finest church in Belgium, is very wide, with its seven-aisled nave, which is carried high and has deep windows in the clerestory. A lofty fifteenth-century spire rises from the north end, and at the crossing of the transepts is a curious little turret, reminding one of Saracenic architecture, set up when Spain was the ruling power in Flanders.

Antwerp Cathedral was built in the Flamboyant period and displays the florid taste of the wealthy Flemish burghers. By accident or most wise design, the second western tower was never carried up more than one story; otherwise the cathedral, like that of Cologne, would have been sadly dwarfed.

St. Gudule, Brussels, a much earlier church, has good western towers, in excellent proportion. There is very beautiful stained glass in the choir chapels. It is perhaps in Tournai Cathedral (1066–1338) that one sees most the passage of the architectural periods in the Low Countries, whose changing history and internal rivalries crushed out any great creative spirit like that which has made France wonderful forever.

There is a distinct charm in Belgian architecture, with its spires, belfries, towers and ridged gables. Bruges Cathedral rises very finely over the peace pool of the town. The churches and cathedrals of Ypres, Ghent and Dinant fit happily into their place and show the influence of changing periods. The cathedrals of Holland, Utrecht, Haarlem, Dordrecht are simple, with very bare interiors, but their shapes are made attractive by the level water light flooding the walls and by the immense and tranquil skies of the Dutch landscapes.

The town halls and guildhalls are really the most characteristic Flemish buildings. Of these the Cloth Hall at Ypres (1304) is the earliest and most imposing. Similar halls were built not much later at Bruges, Louvain, Malines and Ghent. The town halls were mostly of later date, the earliest being that of Brussels (1377), then Louvain (1448–63) and Oudenarde in the early sixteenth century.

PURE GOTHIC ARCHITECTURE RARE IN ITALY

In certain parts of Italy pure Gothic architecture never appeared. The Gothic spirit was part of the miracle of the Italian Renaissance, as we remember in our earlier chapters on painting and sculpture, but its expression was altered by existing forms and traditions. Rome, the stronghold of classic art, closed her doors against this northern invader; there is only one Gothic church, Santa Maria sopra Minerva, in the whole great area of the eternal city.

Elsewhere in Italy the resistance of Romanesque and Byzantine traditions was great. The high-flung vaults of northern France were not suffered to rise; there were few flying buttresses and pinnacles; roofs were kept flat, windows small. The main feature of French Gothic had been upward-soaring lines; the Italian architects insisted on horizontal ones. The result is a most interesting group of buildings, but they can hardly be called Gothic.

The nearest in spirit to the buildings of the north, and the exception to several of the rules of Italian Gothic, is Milan Cathedral, and it is more German than French in plan. This great marble pile, which took a hundred years to build and absorbed the energies of half a hundred architects, is one of the most wonderful creations of a wonderful period.

It is the second largest cathedral set up in medieval times. But the merit of the building is something not measurable by square feet; nor is it flawless in style and proportion. Its numberless pinnacles and points, surmounted by statues, seem as if they were stalagmites flung upward from a fairy grotto. The long, horizontal lines of the building are broken only by long, narrow windows and unobtrusive buttresses, the whole formation delicately hung in a web of vertical strands. Huge as a fortress, it seems as delicate as a lace shawl.

The Duomo at Florence, also called Santa Maria del Fiore, is a building of a very different kind. It was erected in the Gothic period, from about the end of the thirteenth century to the middle of the fifteenth, but in spirit it is Italian Romanesque. It is a remarkable structure, in plan a long cross of an unusual type. The nave leads up to a great domed octagonal space, and from this three apses, each domed, break out, one in the eastern end in the usual way, and twin apses in place of transepts. Five chapels cluster round each apse.

To pass from the nave into this great area of radiating shapes is to receive an unforgettable impression of majesty and dignity. A quaint clerestory of circular lights is set high in the nave walls. The general effect of the exterior, with its colored marble panels and small windows, is horizontal—long lines following each other round the entire building, and all leading on to receive the weight and insistence of the massive dome. The decorating of the west front was begun in the thirteenth century and left untouched till late in the nineteenth.

Round this cathedral much ambition and pride and many lives have gathered. We know something of the immense pride of the Florentines in their city and their art from our earlier chapters, and the cathedral, with its campanile and the baptistery standing close by, is the large monument of their heroic spirit. Famous names run in and out of its story. The first architect was Arnolfi di Cambio. Some time after his death Andrea Pisano and Francesco Talenti took up the work. The crowning labor, in more ways than one, was the huge dome set up by Brunelleschi when Renaissance architecture was developing in Italy.

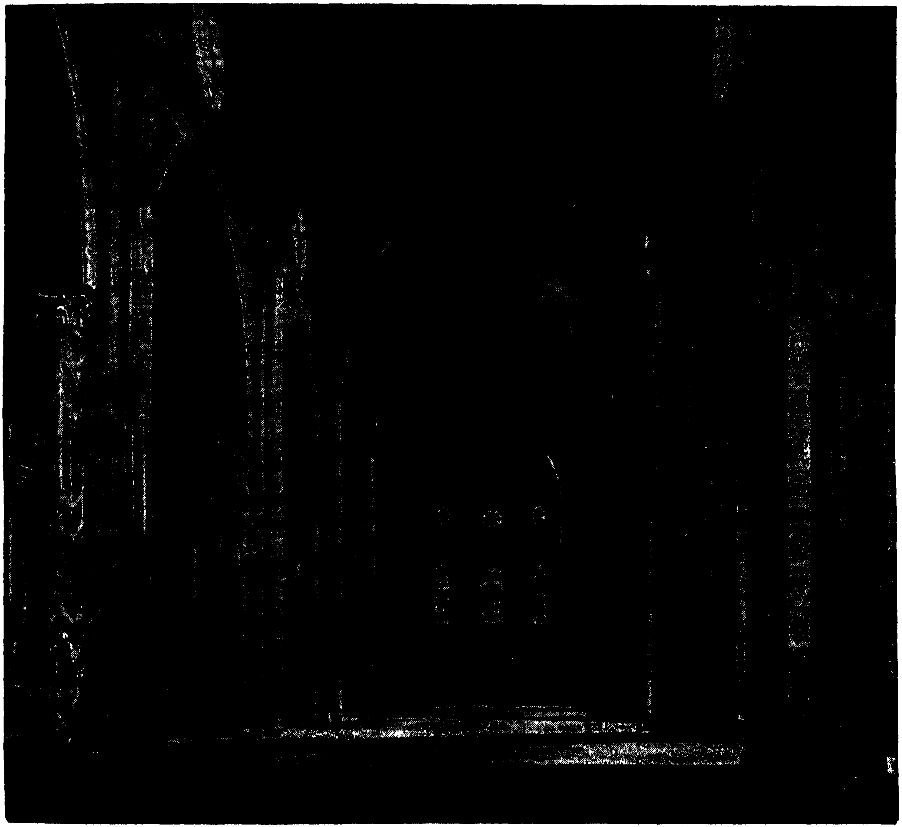
The baptistery is a Romanesque building to which Arnolfi di Cambio made alterations in the late thirteenth century. It is octagonal in shape and faced outwardly with black and white marble. This building is famous for its marvelous bronze doors, the work of Ghiberti and Andrea Pisano, of which you can see a picture on page 1741.

The campanile was designed by Giotto, a truly Italian structure of great beauty. As in the case of most Italian towers, like those at Siena, Mantua, Lucca and Verona, the contour is unspoiled by buttress projections; the slender shaft rises cleanly from the ground, its walls a lovely pattern of colored marble panels and sculptured reliefs. This tower, contrasting with the horizontal lines of the cathedral, and balancing the heavy mass of the dome, finishes one of the finest groups of medieval architecture in Europe.

In addition to the cathedral, Florence possesses some very fine churches—Santa Croce, planned by Arnolfi di Cambio; Santa Maria Novella, whose architects were two Dominican monks; and Or San Michele, planned by Taddeo Gaddi. Or San Michele possesses some particularly lovely statuary by some of her famous sculptors, like Donatello and Ghiberti. In Santa Croce are sculptured tombs to many notable persons.

When we think of Italian churches we think first and foremost of the historic San Francesco at Assisi, set up in the middle of the thirteenth century. It is built on a hillside in two stories. The style is simple: there are no aisles, and both the upper and lower church end in an angular apse. It is not only a most interesting architectural work, but a monument to a man whose story is eternally bound up in the early years of the Italian Renaissance. We know, from our chapters on painting, of the frescoes that adorn the dim, vaulted interiors of the upper and lower church.

The cathedral at Siena, set up as a kind of stepped platform on the sloping ground, is a fine and imposing building, marked, like most of the Italian Gothic



The interior of the Church of Santa Maria Sopra Minerva in Rome.

cathedrals, with a dome over the wide space at the crossing. All the artists of the town helped to set up and adorn this their chief church, and their pride in it was immense. It was planned on a huge, ambitious scale. The actual building took from 1245 to 1380, but the proposed second nave, a continuation of a transept, has never been finished. On floor and walls, outside and inside, the art of Siena has stamped her cathedral. One of its most renowned features is the pulpit carved by Niccola Pisano.

In the cathedrals of Orvieto and Palermo, and in churches like San Antonio, Padua, San Giovanni and Santa Maria Gloriosa, Venice, Sant' Anastasia, Verona, and San Petronio, Bologna, the art of Gothic years in Italy produced wonderful and memorable work. The farther south we go, the more remote from pure Gothic is the style. The metropolitan church at Palermo is built on the plan of the old basilican churches, and reminds us more of Saracenic architecture than Gothic. In almost every Italian church there are sculpture and adornment by great artists. Some churches were built by monks out of love of God; some by citizens out of pride in their city.

THE INFLUENCE OF THE MOORS IN THE BUILDINGS OF SPAIN

We spoke just now of Milan Cathedral as the second largest in medieval Europe. The first in point of size is the cathedral of Seville, which, except for St. Peter's, Rome, is the largest church in the world; and this brings us into that strange and attractive world of Spanish art, where the genius of the so-called Moors has left an ineradicable strain of beauty. Some of the most delightful work of Europe hides in odd corners of Spain: doorways which make one think, curiously, of some haunting song that is native to no one country or period; walls that strike a dreaming silence, as if the world had forgotten to pass that way.

In the north of the peninsula, naturally, in Catalonia, the influence of Gothic was most felt. But pure French Gothic is almost unknown. The architects threw up great vaulted buildings, and nestled little chapels between the buttresses, so that the walls seem flat outside. Horizontal rather than vertical lines mark the structures. Windows are not huge, as in the north of Europe; cloisters of great beauty, as at Barcelona, Segovia, Toledo and Lerida, are ornamented in a style natural to the inheritors of Saracenic art. The style of the horseshoe arch, the endless geometric wall-decoration, and the open stonework of Moorish times passed on through the short Romanesque period—whereof few traces remain—and allied itself naturally with Gothic, making a different architecture from the rest of Europe.

Seville Cathedral was built in the fifteenth and early sixteenth centuries on the site of a Mohammedan mosque. Its great masses are grouped unfamiliarly, but the structure nevertheless achieves a distinction not given by hugeness alone. Its lovely stained glass throws shafts of color across the great aisles, each as wide as the nave of Westminster Abbey, and makes even richer the rare carvings and ornamentations. In a smaller place the adornments would be too heavy, but the cathedral is proportioned very happily. Were the exterior as graceless as a barn, it would still be saved by the Giralda, one of the loveliest towers in the world, of which we have already spoken.

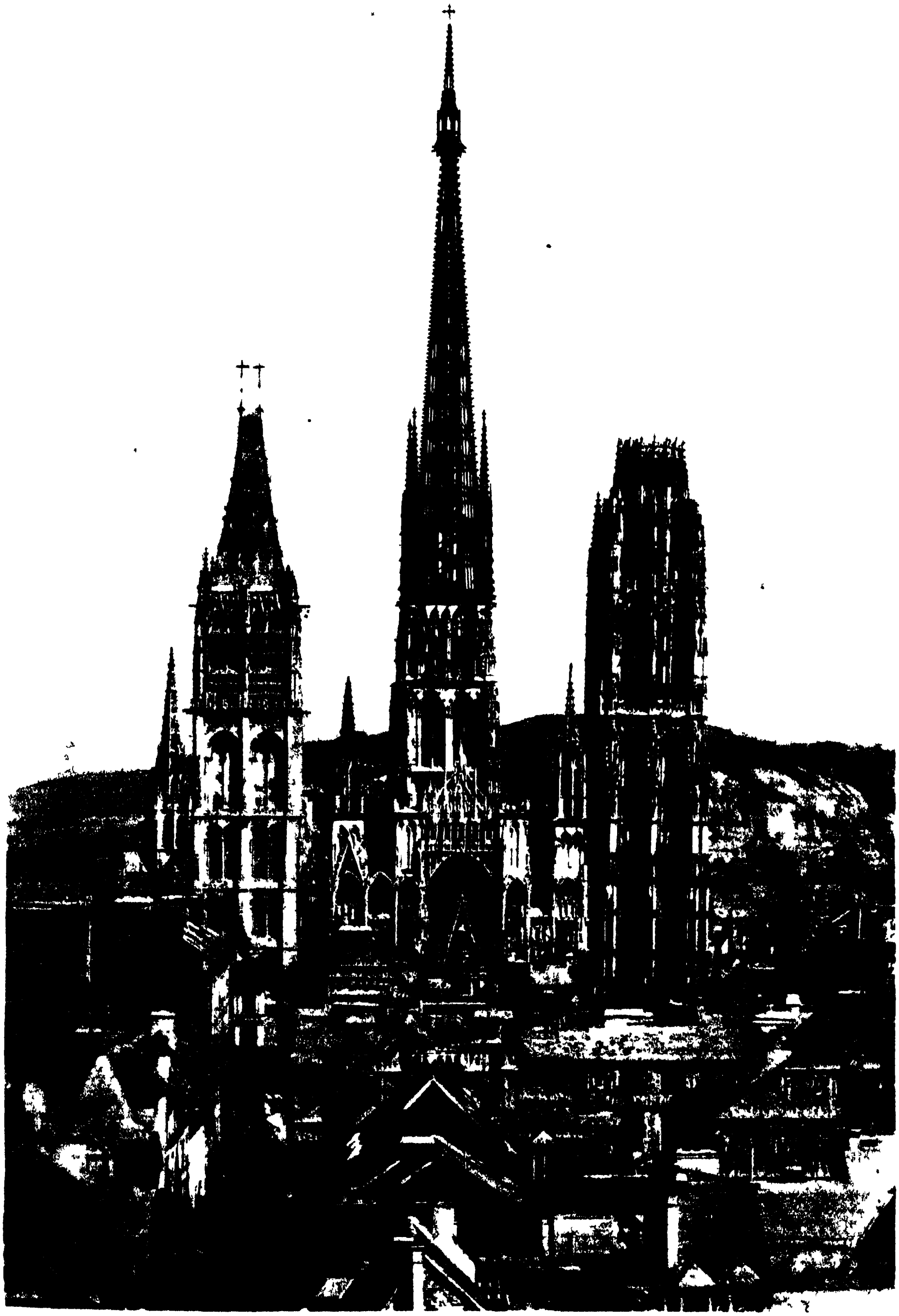
All the medieval cathedrals and churches of Spain are intensely interesting. One feels continually that history no less than the architect has been planning and shaping here. Of no one building could it be said that it is purely such and such a style. The cathedrals of Valencia and Leon, set up in the thirteenth century, remind one suddenly of France; Barcelona is a little Italian in shape. Toledo, Avila and Gerona are marked by rich interior carvings.

Burgos, begun between 1220 and 1230, is perhaps the most romantic and Spanish of all the cathedrals in the peninsula. One of the loveliest doorways in Europe is that of San Pablo, Valladolid. It might be classed as Gothic, but the long-dead Saracens guided the builders' hands.

Spain was too conservative, for all her upheavals, to allow herself the fine, undivided enthusiasm of early France. As we think of her sacred buildings we wish perhaps that she had expressed herself singly and loudly in some one great way, as the Gothic architects expressed themselves in France. Then when we look at her work again and see, here the Saracen, here the Romanesque, here the Gothic, and everywhere the sense of Spanish art, we would not have her changed at all.

THE NEXT STORY OF THE FINE ARTS IS ON PAGE 6257.

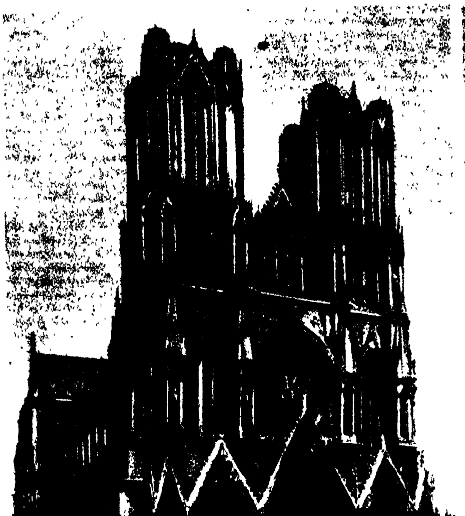
BUILDINGS OF EUROPE'S GOLDEN AGE



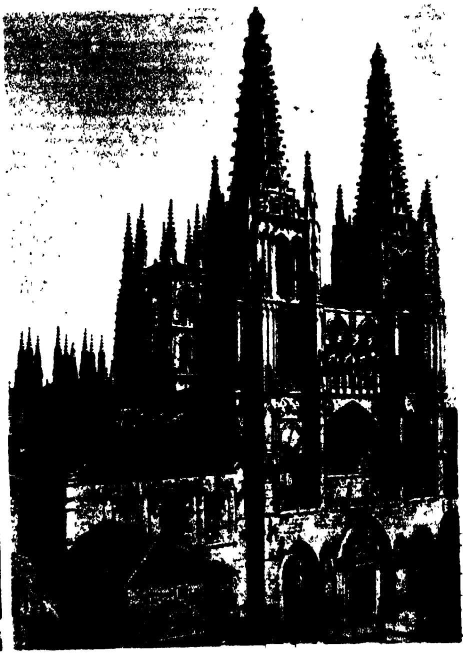
THE WEST FRONT OF THE BEAUTIFUL CATHEDRAL AT ROUEN

WEST FRONT OF STRASBOURG CATHEDRAL

THE HALLES WITH THE FAMOUS BELFRY AT BRUGES

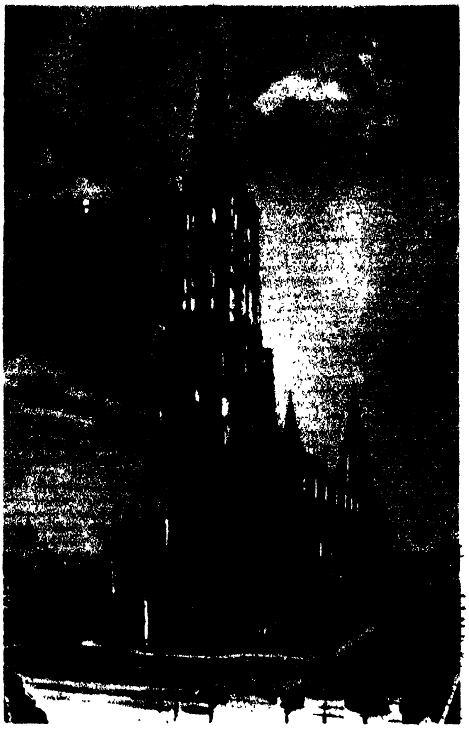


RHEIMS CATHEDRAL BEFORE WORLD WAR I

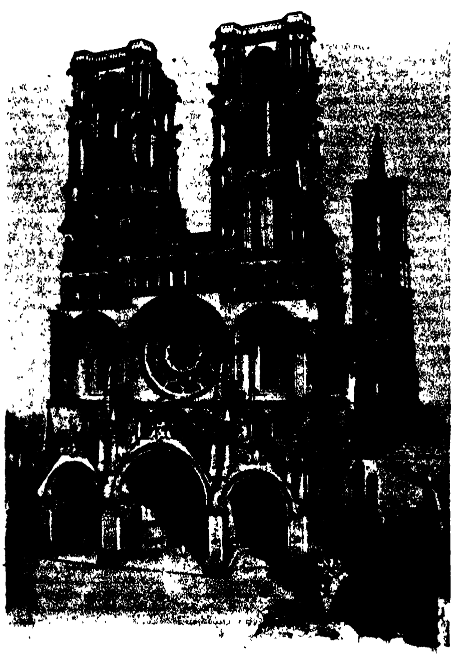


BURGOS CATHEDRAL, IN SPAIN

THE CATHEDRAL OF NOTRE DAME IN ANTWERP

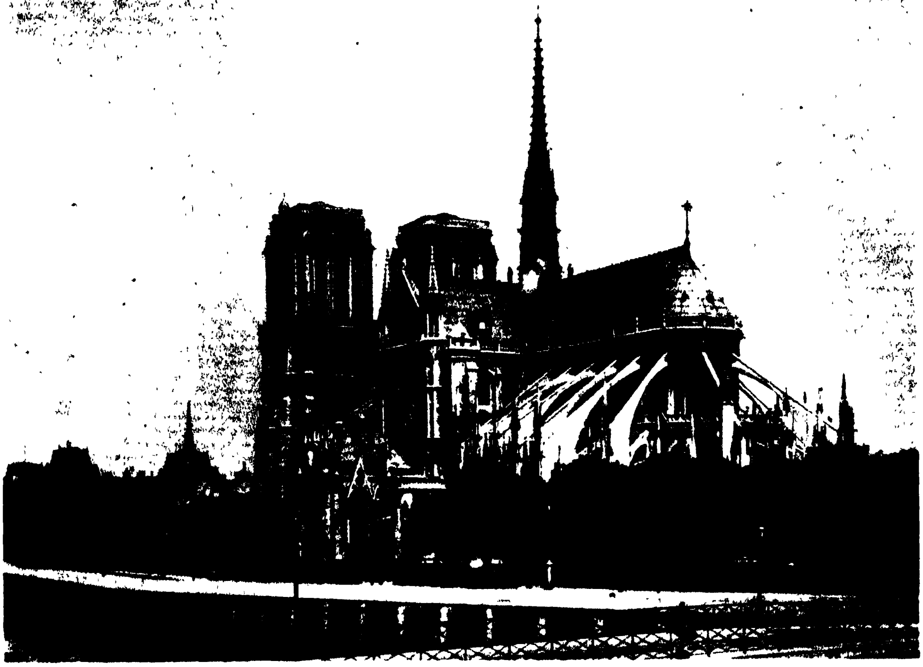


ULM CATHEDRAL, IN GERMANY

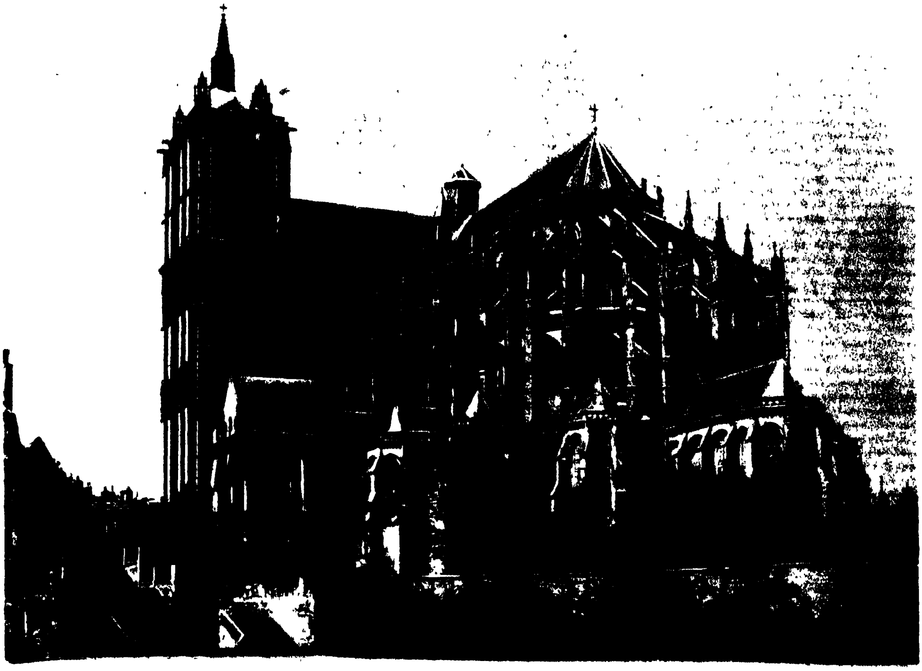


NOTRE DAME AT LAON

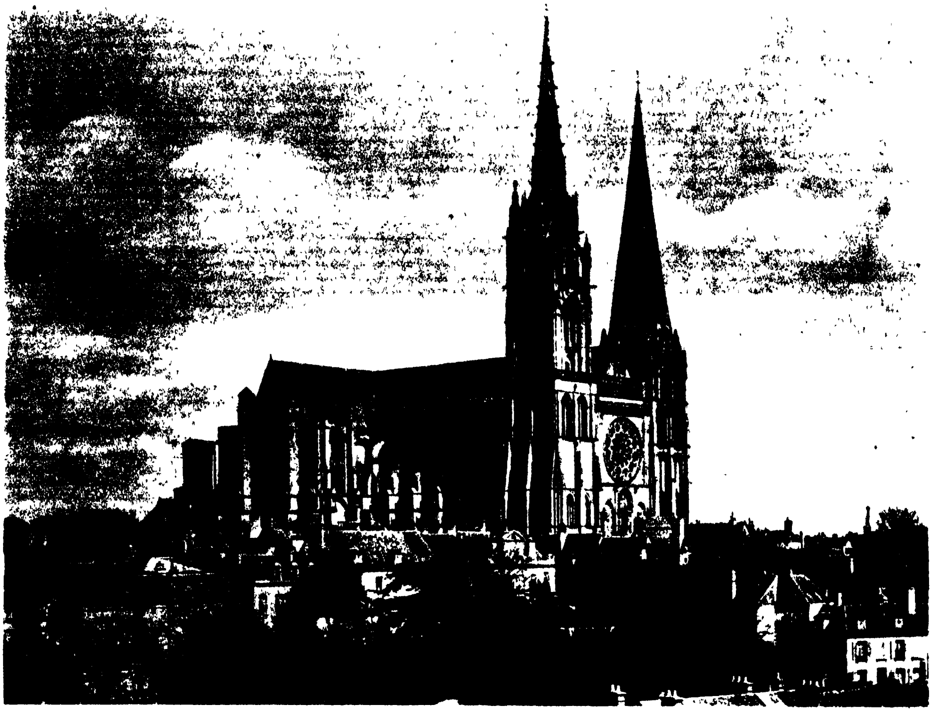
AMIENS CATHEDRAL



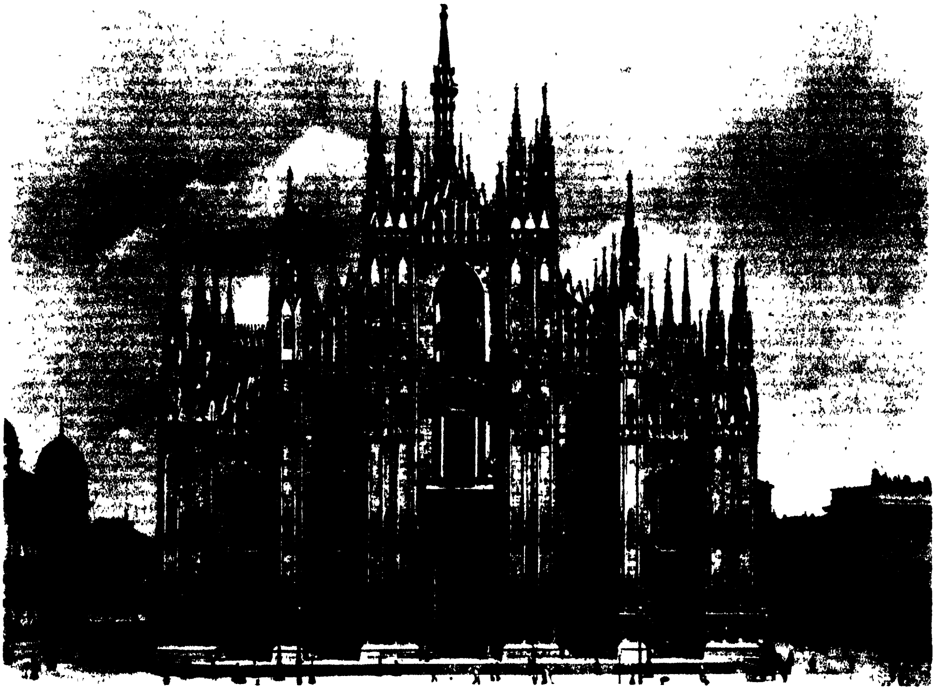
THE BEAUTIFUL CATHEDRAL OF NOTRE DAME IN PARIS, SHOWING THE APSE



THE APSE OF THE CATHEDRAL OF ST. JULIEN AT LE MANS

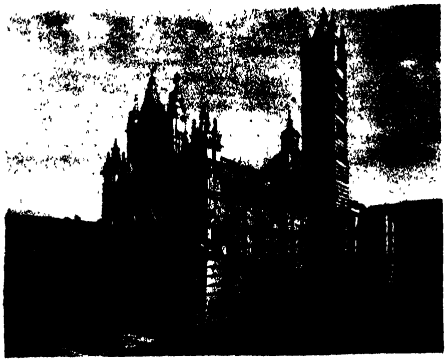


THE NORTH SIDE AND WEST FRONT OF CHARTRES CATHEDRAL



THE FRONT OF THE WONDERFUL CATHEDRAL OF MILAN

COLOGNE CATHEDRAL

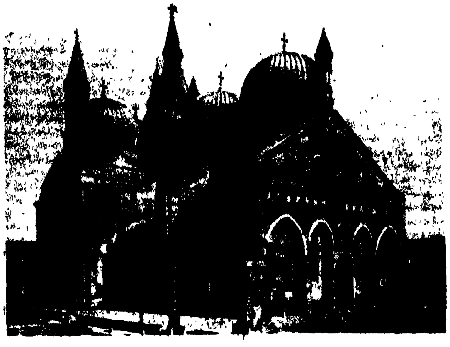


SIENA CATHEDRAL

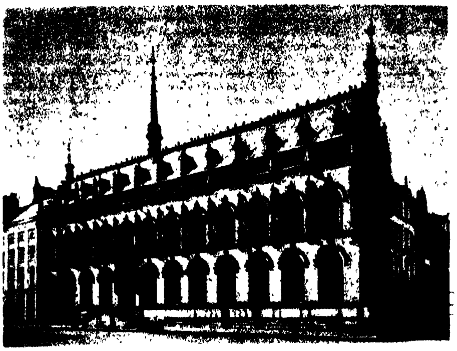
THE SAINTE CHAPELLE IN PARIS

RATISBON CATHEDRAL, IN GERMANY

THE CHURCH OF SAN FRANCESCO AT ASSISI

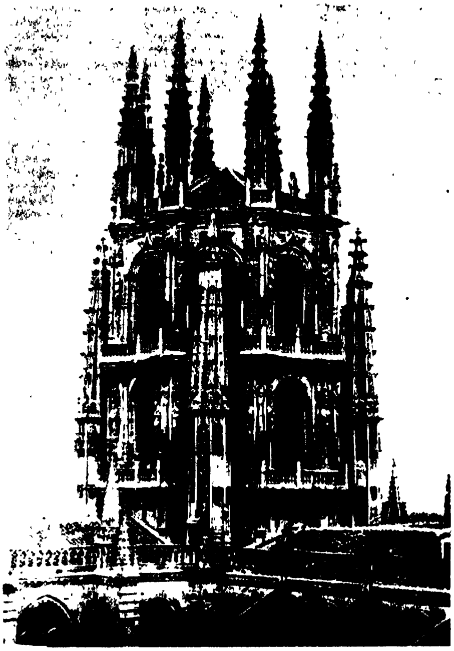


THE CHURCH OF SAN ANTONIO AT PADUA


THE HOTEL DE VILLE AT COURTRAI

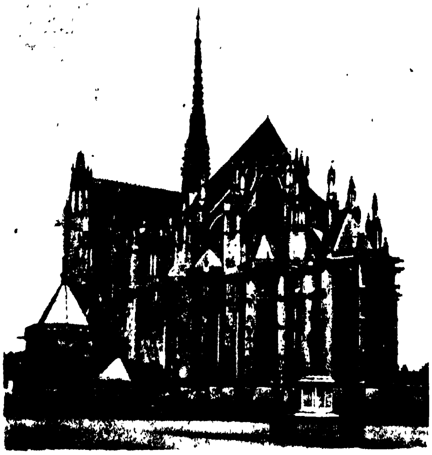
THE OLD CATHEDRAL AT CARCASSONNE

ST. STEPHEN'S CATHEDRAL IN VIENNA

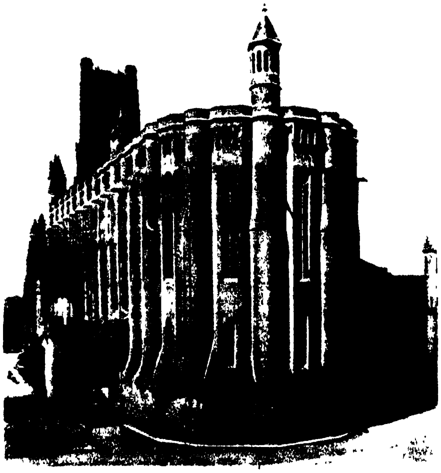

BURGOS CATHEDRAL, SHOWING THE LANTERN

NOYON CATHEDRAL BEFORE THE WORLD WAR

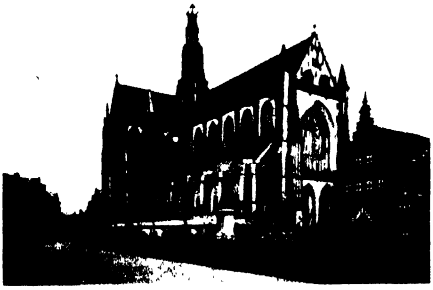
SENLIS CATHEDRAL, IN FRANCE



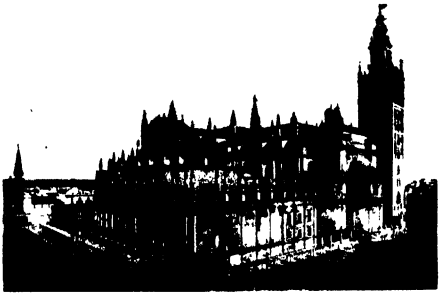
THE APSE OF AMIENS CATHEDRAL



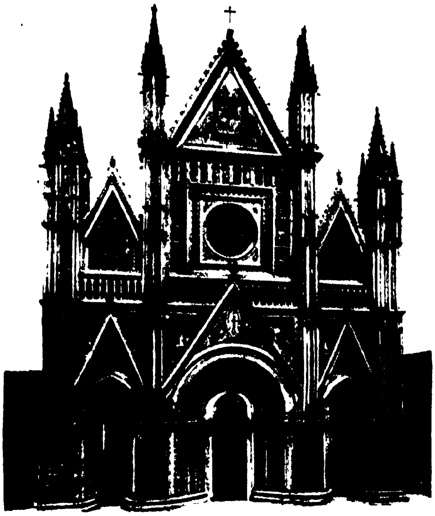
ALBI CATHEDRAL, IN FRANCE



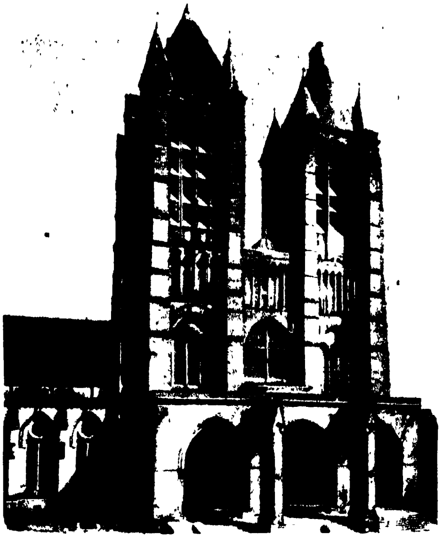
THE GREAT CHURCH AT HAARLEM, IN HOLLAND



THE CATHEDRAL AT SEVILLE



ORVIETO CATHEDRAL, IN ITALY



NOYON CATHEDRAL BEFORE WORLD WAR I

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Why are United States People Called Americans?

Citizens of the United States often call their land America and themselves Americans. Canadians and Latin Americans sometimes resent this for they also live on the American continents and are, therefore, Americans, too.

The practice arose more than a century and a half ago, when the United States was the only independent nation on the Western Hemisphere. The complete official name of the country, the United States of America, was too long for everyday common use, so the shorter form, America, became accepted. As for the people, it would not sound well to call them "United Statesans," so the name Americans was generally used.

The people of South and Central America are often called Latin Americans. That is because many of them are descended (at least in part) from Spanish and Portuguese ancestors. Spain and Portugal are countries whose languages and civilization come from the ancient Latin language and civilization. Spanish is, even today, the official language of most Central American and South American countries. In Brazil, which was once a colony of Portugal, Portuguese is spoken.

South American people frequently speak of the inhabitants of Canada, the United States and Mexico as North Americans, and of themselves as South Americans.

WHO DESIGNED THE STATUE OF LIBERTY?

The Statue of Liberty, a colossal figure representing Liberty Enlightening the World, was designed by a French sculptor, Fréderic Auguste Bartholdi, a native of Alsace, and was presented to the people of the United States as a gift from the people of France. The statue is on Bedloe's Island, or Liberty Island, in New York Harbor. It was unveiled in 1886, the majestic figure of a woman holding aloft in her right hand the torch of liberty. In her left arm she carries a tablet bearing the date of the Declaration of Independence, July 4, 1776. The statue is 151 feet high. The top of the torch stands over 300 feet above the sea. The weight is 450,000 pounds. Forty persons can stand in the head, reached by a winding stairway.

The statue is made of copper plates over an iron and steel frame. The torch, usually lit up at night, is glass.

WHERE DOES THE NAME DIXIE COME FROM?

Dixie, the affectionate nickname for the southern part of the United States probably came about in this way. A kindly slave-owner named Dixie, in New York, sold his slaves to a Southern cotton-planter, when slavery was forbidden in the North. His former slaves talked so much of "Dixie's land," where they had been happy, that it came to be regarded as a sort of Paradise. When D. D. Emmett wrote the song DIXIE he may not have known that "Dixie's land" was in the North, or he may have thought the song would have more appeal if it were placed "way down south in de land ob cotton." At any rate nowadays when we speak of Dixie we are referring to the South.

HOW DID THE WORDS "IN GOD WE TRUST" COME ON COINS?

On all gold and silver coins of the United States large enough to hold the words is put the inscription "In God We Trust." It is said that the idea originated with James Pollock, who was governor of Pennsylvania from 1854 to 1857. During the Civil War, believing that the recognition of God on the national coinage was a national duty, he wrote to the Secretary of the Treasury and urged that this motto should be put on all the coins of the United States. The suggestion was approved by Congress, and a bill was passed unanimously by the Senate and the House of Representatives authorizing the motto. The motto was first used in 1864.

WHO WROTE THE PLEDGE TO THE FLAG OF THE UNITED STATES?

The Pledge to the Flag of the United States was written in 1892. Two men, James B. Upham and Francis Bellamy, of the staff of THE YOUTH'S COMPANION, a magazine for young folks published in Boston, worked upon the wording of the Pledge. The Pledge to the Flag is as follows: I pledge allegiance to the Flag of the United States of America and to the Republic for which it stands; one nation indivisible, with liberty and justice for all.

WHAT IS THE ORIGIN OF THE DOLLAR SIGN?

The dollar, the standard unit of money in the United States, Canada, Mexico and several other countries, has a most interesting history, and so has the $ generally used to represent it.

The word dollar comes from the Low German for *Thaler,* which is an abbreviation of *Joachimsthaler.* Joachimsthal (Joachim's dale) is a little town in Bohemia near which, in the beginning of the sixteenth century, a rich silver mine was discovered. The feudal lords of the town had coins made that, because of their excellence, were soon used all over Europe. These and similar coins were called *Joachimsthalers,* or simply *Thalers.*

Coins of similar value were issued in Spain. They were called pieces of eight, because their value was divided into eight smaller coins. All these coins circulated freely in the colonies in both North and South America. In North America they were called dollars.

When the United States had been formed, the word dollar was adopted definitely for its unit of coinage; but the sign for the new coin was that of the old Spanish piece of eight. This sign showed the figure 8 (which strongly resembles the letter S), crossed by two lines representing the Pillars of Hercules, the gateway between Mediterranean and Atlantic at the southernmost tip of Spain. Thus the dollar sign really has nothing to do with the letter S, nor was it, as some people believe, originally formed by placing a narrow U over an S to form the monogram of the United States.

WHAT IS THE MEANING OF DEMOCRACY?

Democracy is a word often used and often misunderstood. It comes from the Greek *demos* (the people), and *kratein* (rule), thus meaning the rule of the people. The Athenian democracy was so called because all the citizens voted directly upon all important questions; but since aliens and slaves were much greater in numbers than citizens it was not a democracy in the truest sense.

The New England "town meeting," in which every citizen may vote on all questions that come up concerning the township, is considered very nearly a pure political democracy. Until about thirty years ago, women did not vote. When the number of inhabitants becomes greater than can be contained in a hall, the system breaks down. Brookline, Massachusetts, is the only considerable town now governed by a town meeting, though somewhat modified. In some smaller towns of New England, however, the system is still in full force and the sessions are often spirited.

In the Middle Ages a system of representation was developed. Representatives were chosen to speak either for a particular group, or for those living in a certain territory. In many countries today, including the United States and Canada this representative system has been adopted. However, in Canada the Senators are appointed, not elected, and in the United States every state, large or small, has equal representation in the Senate. In the United States the president is not directly elected by the people, but by an electoral college, and there have been several presidents chosen by a minority of the voters. Neither Canada nor the United States is, then, even a pure representative democracy.

Several schemes to give people greater power have been adopted in some of the states. A certain proportion of the voters may, by petition, force a measure to be submitted to a vote of the people, even if the legislatures do not act. This is called an initiative. On the other hand, if a large group feels that the legislature has not voted wisely on a matter, the measure may be submitted to a vote of the people. If a majority votes against the measure it is null and void, in spite of the legislative vote. This is called a referendum. In some states an official may be removed from office by popular vote. A proceeding of this sort goes by the name of recall.

All of these deal with what is called political democracy. The word "democracy" is also used in discussing other divisions of human life.

Those who advocate economic democracy say that the workers should have a greater voice in the conditions of their work, wages, hours, security, choice of overseers and foremen and the like. Some people advocate greater equality of wages.

By social democracy is meant the abolition of all bars that give advantage or disadvantage to one group or class.

WHY IS THE UNITED STATES OFTEN CALLED UNCLE SAM?

The use of the name Uncle Sam for the United States has been common for more than a hundred years. No one knows for certain how it began, but there is an explanation that appeared in print about 1840, and may be true. The story goes that a contractor named Elbert Anderson was furnishing some supplies for the United States Army during the War of 1812. On the barrels and boxes were stamped his initials E.A., and U. S. for the United States. Some one asked what those letters meant and a wag, for a joke, answered that he supposed they meant "Elbert Anderson and Uncle Sam," meaning Samuel Wilson, an old gentleman who was the local inspector of army supplies. Whether this is how the use began, no one really knows, but it soon spread over the country. After a while Uncle Sam was pictured as a tall slender old gentleman with a thin beard, dressed in old-fashioned clothes with a white or gray tall hat. Sometimes the clothes of Uncle Sam are made of American flags. Now this figure is recognized everywhere in the world as representing the United States, just as the stout figure of John Bull is accepted as representing England. Both figures are very helpful to cartoonists.

A. F. Sozio

Five of the niches in the impressive Hall of Fame, a semicircular colonnade, at New York University.

WHAT IS THE HALL OF FAME?

The Hall of Fame for Great Americans, at New York University in New York City, is a memorial to famous American men and women. It is a semicircular granite colonnade, 630 feet long, connecting two buildings of the university. The colonnade consists of a double row of columns supporting a roof. Each row rests upon a wall four feet high.

Against this wall, on either side of the central pathway, are set panels for 150 bronze tablets. Seventy-seven tablets have already been put in place. Each contains the name of a great American, the dates of his birth and death and a suitable inscription. On the top of the wall, above, set between two columns, is a bust of the person honored by the tablet.

The Hall of Fame, the gift of Helen Gould (Mrs. Finley J. Shepard), was built in 1900. At that time it was announced that a College of Electors, made up of a hundred distinguished persons, from every state in the Union, would choose *fifty* names in 1900 and would add five names every five years until 150 had been chosen. This plan has not been closely followed.

The rules for selecting names for the Hall of Fame have been changed several times. At present any man or woman born in the United States, or a person whose work is thoroughly American, may be elected. Persons so honored must have been dead for at least twenty-five years.

The American public suggests names to the senate of New York University. The senate refers a number of these names to the College of Electors, which votes on them. A three-fifths vote is necessary for a choice. Here are the names of the men and women now honored in the Hall of Fame, and the year in which they were chosen.

1900: John Adams, John J. Audubon; Henry W. Beecher; William E. Channing; Henry Clay; Peter Cooper; Jonathan Edwards; Ralph W. Emerson; David G. Farragut; Benjamin Franklin; Robert Fulton; Ulysses S. Grant; Asa Gray; Nathaniel Hawthorne; Washington Irving; Thomas Jefferson; James Kent; Robert E. Lee;

Abraham Lincoln; Henry W. Longfellow; John Marshall; Horace Mann; S. F. B. Morse; George Peabody; Joseph Story; G. C. Stuart; George Washington; Daniel Webster; Eli Whitney.

1905: John Q. Adams; James R. Lowell; Mary Lyon; James Madison, Maria Mitchell; William T. Sherman; John G. Whittier; Emma Willard.

1910: George Bancroft; Phillips Brooks; William C. Bryant; James F. Cooper; Oliver W. Holmes; Andrew Jackson; John L. Motley; Edgar A. Poe; Harriet B. Stowe; Frances E. Willard.

1915: Louis Agassiz; Daniel Boone; Rufus Choate; Charlotte S. Cushman; Alexander Hamilton; Joseph Henry; Mark Hopkins; Elias Howe; Francis Parkman.

1920: Samuel L. Clemens (Mark Twain); James B. Eads; Patrick Henry; William T. G. Morton; Alice F. Palmer; Augustus Saint-Gaudens; Roger Williams.

1925: Edwin Booth; John P. Jones.

1930: Matthew F. Maury; James Monroe; James A. M. Whistler; Walt Whitman.

1935: Grover Cleveland; Simon Newcomb; William Penn.

1940: Stephen Collins Foster.

1945: Booker T. Washington; Thomas Paine; Walter Reed; Sidney Lanier.

WHY SHOULD WE HAVE STATE FLOWERS OR NATIONAL FLOWERS?

We have national and state flowers to help us to remember. The flag is a high and holy symbol. It teaches us to remember the might and majesty and the honor of the nation; its loyalty to justice and truth, and the purity of its great ideals. But, after all, just as every nation is made up of individuals and families, for each one of us our country centers round our home. The flower that grows beside the doorstep, by the spring, down in the orchard, or in the field beyond the wood, speaks to us of that home. When you grow older you will realize how a flower, or even a whiff of its odor as you pass it by, brings back to you some scene of your childhood days.

So we say flowers are for remembrance, and the state or national flower is to keep us in remembrance of our homes and our country.

The oldest of the national flowers is the violet, which was adopted by the city of Athens in the days of its glory. Then comes the shamrock of Ireland, though the leaf, and not the flower, in this case, is the national emblem. Most of us know the story of how, when his pagan listeners could not understand the Christian doctrine of the Trinity, St. Patrick picked a spray of the shamrock which bloomed on the ground at his feet. "Do you not see," he said, "in this wild flower how three leaves are united on one stalk, and will you not then believe what I tell you, that there are indeed three Persons and yet one God?" On St. David's Day in the year 640, when the Angles and Saxons were trying to invale Wales, the Britons of Wales, with Caedwalla as their leader, sought to drive the invaders away. To distinguish himself from the foe, each man in the Welsh army plucked a leek and placed it in his cap. The Welshmen were victorious, and from that day on the leek has been the national emblem of Wales.

The story of the Scotch emblem is somewhat similar. The Danes, who invaded Scotland in the eleventh century, sought to take a fortress by surprise, and removed their shoes to swim across the moat at night. In the darkness they plunged into the moat, to find that it was full of thistles instead of water. Their cries of pain warned the garrison, and the attack was repulsed. Scotland was saved, and in remembrance of the victory the purple thistle flower was adopted as the national flower.

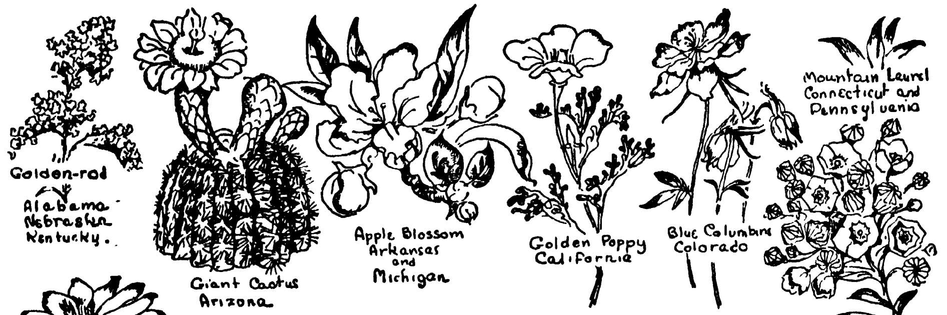
The rose of England brings us back to the Wars of the Roses, when the Yorkists wore a white rose and the Lancastrians a red rose as a badge. Henry VII, a Lancastrian, married a daughter of the House of York, and made a red and white rose the badge of England.

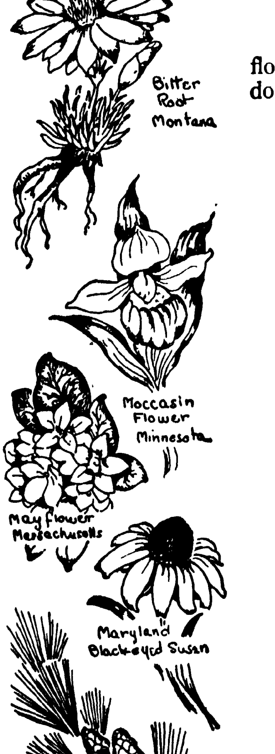
Louis VII of France took the white fleur-de-lis, probably the white iris, for his badge, when he went to the Holy Land on a crusade, as a symbol of the purity of his motives, and the lily became the emblem of France.

The blue cornflower reminds the German people of Queen Louise, the brave and gentle queen of Prussia who, when she fled to the fields to escape being taken prisoner by Napoleon in Berlin, amused her children by weaving wreaths for them of this pretty flower.

The maple tree has always had a special place in the affections of the Canadian people, and early in the history of the country the maple leaf was adopted as a national emblem. The following Canadian provinces have officially chosen flower emblems—Manitoba, the Pasque flower, Nova Scotia, the mayflower, Alberta, the wild rose, Ontario, the white trillium, and New Brunswick, the violet, shy blossom of northern woods.

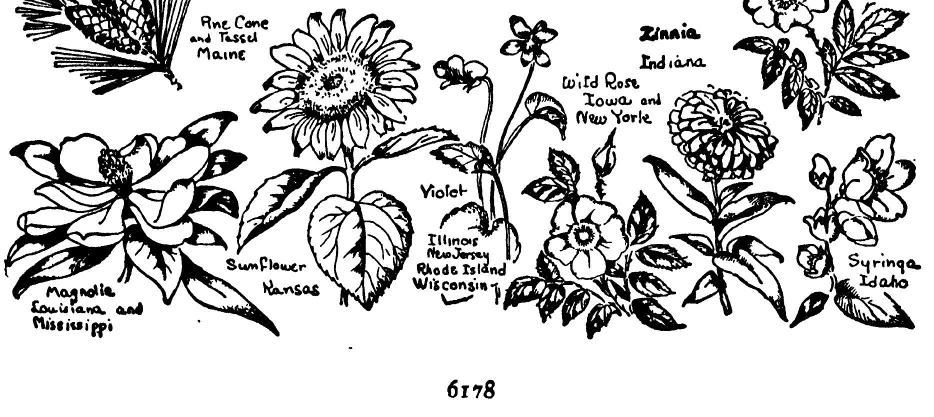
FLOWERS OF THE STATES



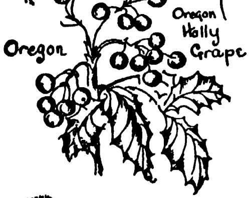


The United States has not yet adopted a flower, but all the states in the Union have done so, and we give you a list of all:

Alabama—*Goldenrod*
Arizona—*Giant Cactus*
Arkansas—*Apple Blossom*
California—*Golden Poppy*
Colorado—*Columbine*
Connecticut—*Mountain Laurel*
Delaware—*Peach Blossom*
Dist. of Columbia—*Am. Beauty Rose*
Florida—*Orange Blossom*
Georgia—*Cherokee Rose*
Idaho—*Syringa*
Illinois—*Violet*
Indiana—*Zinnia*
Iowa—*Wild Rose*
Kansas—*Sunflower*
Kentucky—*Goldenrod*
Louisiana—*Magnolia*
Maine—*Pine Cone and Tassel*
Maryland—*Black-eyed Susan*
Massachusetts—*Mayflower*
Michigan—*Apple Blossom*
Minnesota—*Moccasin Flower*
Mississippi—*Magnolia*
Missouri—*Hawthorn*
Montana—*Bitter Root*
Nebraska—*Goldenrod*

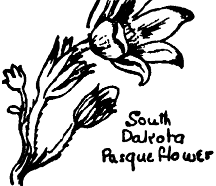


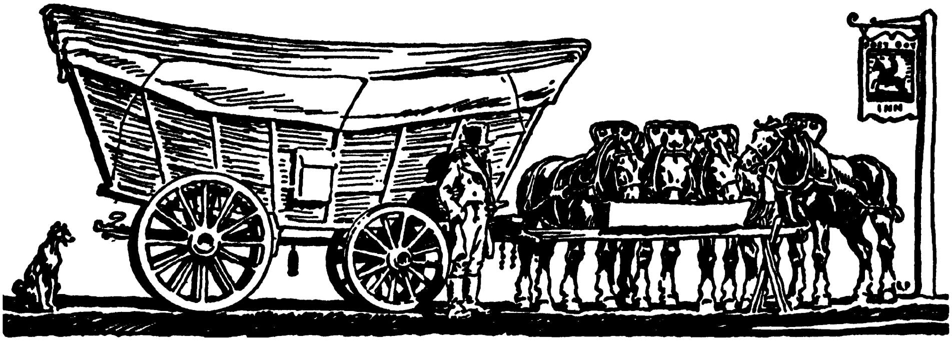
MOST OF THESE ARE WILDFLOWERS



Nevada—*Sagebrush*
New Hampshire—*Purple Lilac*
New Jersey—*Violet*
New Mexico—*Yucca*
New York—*Wild Rose*
North Carolina—*Dogwood*
North Dakota—*Wild Prairie Rose*
Ohio—*Scarlet Carnation*
Oklahoma—*Mistletoe*
Oregon—*Oregon Holly Grape*
Pennsylvania—*Mountain Laurel*
Rhode Island—*Violet*
South Carolina—*Yellow Jessamine*
South Dakota—*Pasque Flower*
Tennessee—*Iris*
Texas—*Bluebonnet*
Utah—*Sego Lily*
Vermont—*Red Clover*
Virginia—*Dogwood*
Washington—*Coast Rhododendron*
West Virginia—*Rosebay Rhododendron*
Wisconsin—*Violet*
Wyoming—*Indian Paintbrush*

Many of these state flowers have been chosen by the school children, but in some cases the state legislatures have named them. If a flower is adopted by the United States as a nation, it will probably be the goldenrod or the columbine.





WHAT WAS A CONESTOGA WAGON?

The Conestoga wagon was a large, heavy wagon designed for carrying freight long distances over rough ground. This type of wagon is said to have been first made in Lancaster County, Pennsylvania, in the Conestoga Valley, before the time of the American Revolution.

Local wheelwrights made the wagons entirely by hand, out of swamp oak, white oak, hickory and other native woods. Village blacksmiths made the iron pieces, which had to be strong to support the heavy freight.

The Conestoga wagon was long and deep. It could carry about 5 tons of freight and was usually drawn by a 6-horse team. It was built with a sag in the middle, so that any displacement of freight in traveling over rough and hilly ground would shift the load inward instead of toward the end-gates. The white hempen homespun cover followed the curves of the body; the front and rear ends had a high bonnet shape. The top of the front hoop was 11 feet from the ground; the cover was about 24 feet long, and the rear wheels were 5 or 6 feet high. When the 6-horse team was pulling, team and wagon stretched a distance of 60 feet, and made an impressive and beautiful picture. The horses' harnesses were often fitted with tall hoops of bells that made a cheerful jingle.

The driver rode the horse nearest the wheel on the left side, or he rode on the "lazy board," a sliding board that was pulled out from the left-hand side of the wagon. From here he could work the heavy brake and control the horses.

Previously, driving had been from the right, and a vehicle kept to the left when passing another coming from the opposite direction. Drivers of the Conestoga wagons first started the custom of keeping to the right, the general driving rule today in Canada and the United States and many European countries.

Conestoga wagons were used first by farmers, to haul produce to market. Later, they carried freight from the eastern settlements to frontier posts, on the other side of the Appalachians, and brought back goods for sale.

WHAT WERE THE MINUTEMEN OF AMERICA?

At the beginning of the American Revolution the United States had no regular army, but many of the colonists belonged to groups of volunteers known as the militia. When war broke out with England, most of these militia men remained on their farms, but they pledged themselves to take the field at a minute's notice when called, thus earning the name of Minutemen. There is a monument to them at Concord, in Massachusetts. The noted sculptor Daniel Chester French designed this memorial.

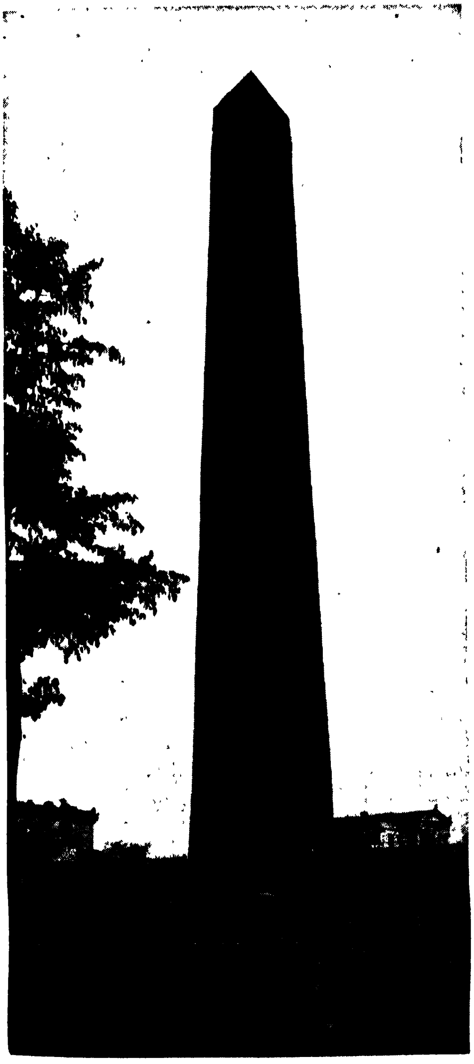
WHY IS BOSTON CALLED "THE HUB OF THE UNIVERSE"?

Oliver Wendell Holmes was himself a Bostonian, but in one of his books he poked good-natured fun at those people who think that Boston is the most important city in the world. He said that the Bostonians thought that the dome of the State House was the center of the universe, and that Boston must therefore be the hub. Laying joking aside, the Bostonians have good reason to be proud of their city. It has always been a leader in great movements. When it was only a little village, Harvard, the oldest college in the United States, was founded there, and the schools of Boston have always been among the best in the country.

The town was early in planning resistance to Great Britain before the Revolutionary War. Many meetings were held at Faneuil

Hall and on Boston Common. Of course you have read THE RIDE OF PAUL REVERE, which you will find in our book. The people of Boston remember the Boston Massacre, and they are proud of Bunker Hill, where the colonists showed the world that they were brave soldiers. Boston Common is still in the center of the city.

The Old North and the Old South churches, King's Chapel, Faneuil Hall and the Old State House still remain to remind one of Revolutionary times. When we stand in one of them the past seems very close. Thousands visit them and the old cemeteries in the heart of the city, where are buried so many of the great men of former days. The Winthrops lie in King's Chapel Burying Ground, which was the first cemetery laid out, and in the Granary Burying Ground are the graves of Samuel Adams, James Otis, Paul Revere and many others of whom you have read.



Philip Gendreau, New York

One of Boston's most famous landmarks, the monument honoring the men who fought at Bunker Hill.

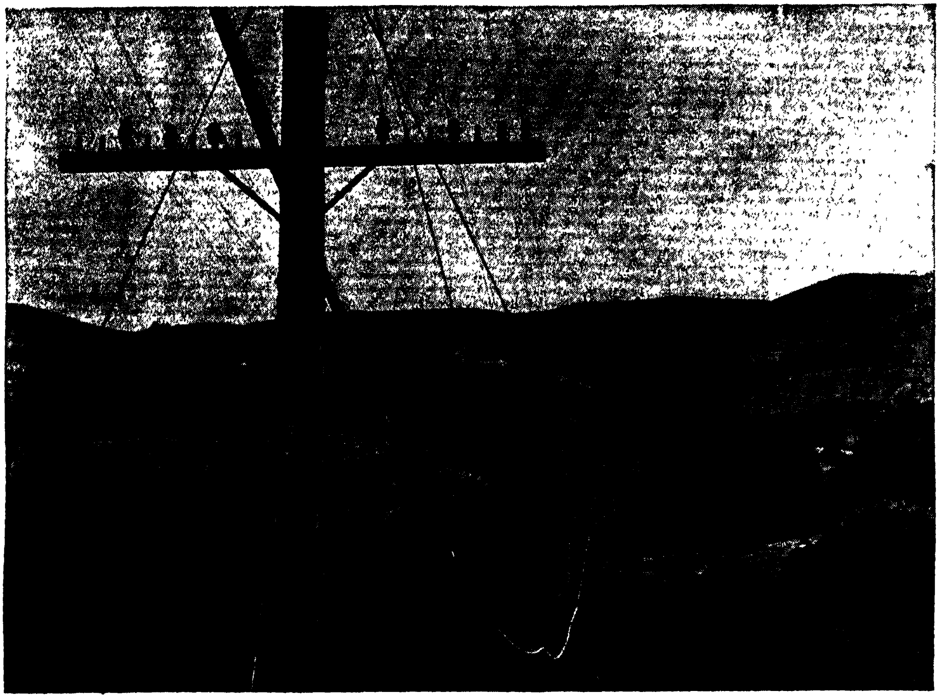
Boston Chamber of Commerce

Boston Harbor, with the Custom House tower at right.

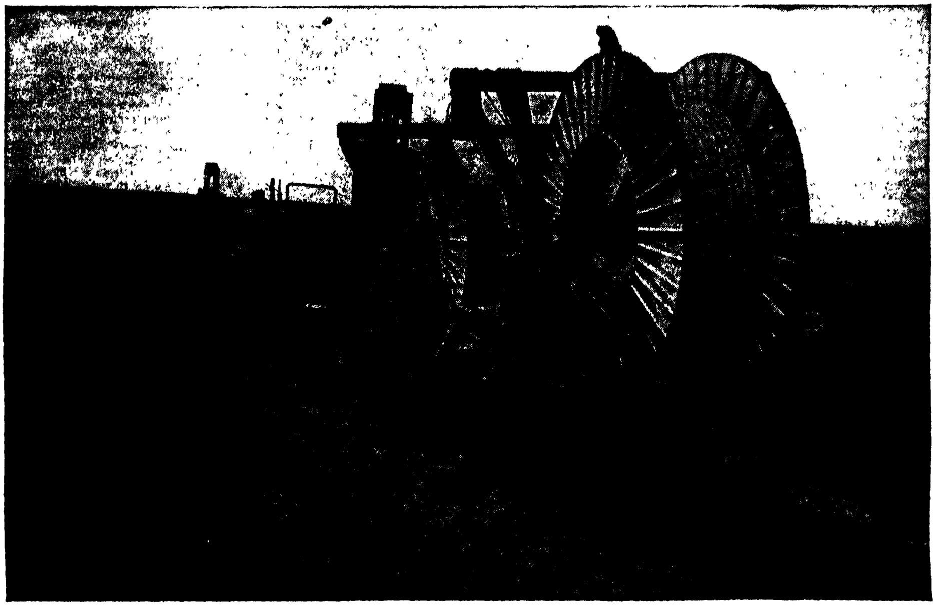
Boston is proud of her later history, too. During the Civil War the city was always strong for the Union and has many monuments of that stirring time. Some of the best statuary in the country is in Boston. The State House, on Beacon Hill, was designed by Charles Bulfinch, and its gilded dome can be seen from afar. The Boston Public Library is one of the most beautiful buildings of the kind in the United States, both inside and out, and many other public buildings make a fine impression. The Museum of Fine Arts has some fine pictures, and its collection of Japanese art is the largest in the world. Many of the greatest writers of America have lived in Boston, and many important books have been written and printed there. The city has one of the best orchestras to be heard anywhere.

THE NEXT WONDER QUESTIONS ARE ON PAGE 6233.

OVERHEAD AND UNDERGROUND CABLES



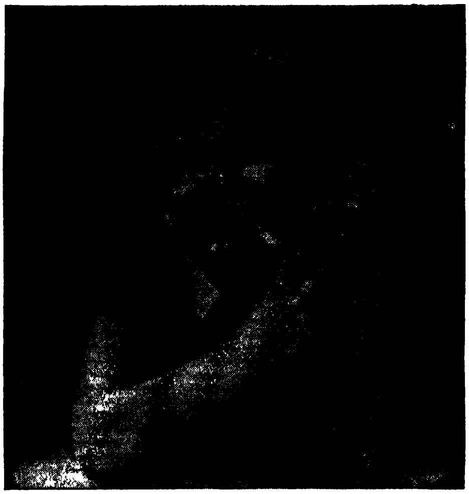
A section of a great cable containing many telephone wires, carried overland on tall poles, between Oakland and Livermore, California. Long-distance telephoning has greatly increased in the past few years.



All pictures in this article courtesy American Telephone and Telegraph Co.

Some long-distance cables are now laid underground, safely out of reach of storm or other damage. Here tractors are drawing plows and cable-laying equipment so that twin cables are being laid in one operation, in trenches three feet deep, all the way from Omaha, Nebraska, to Sacramento, California.

THE WONDER OF THE TELEPHONE



A GOOD many years ago, at a public dinner in a New York hotel, a telephone instrument stood at every place. During the evening it was announced that a gentleman in San Francisco, known to all the guests, would speak to his friends. The diners took up their receivers, and, clearly and distinctly, not only the words but the very tones of their friend came to them across three thousand miles of mountain, valley and plain. This was considered very wonderful then, but greater wonders have followed.

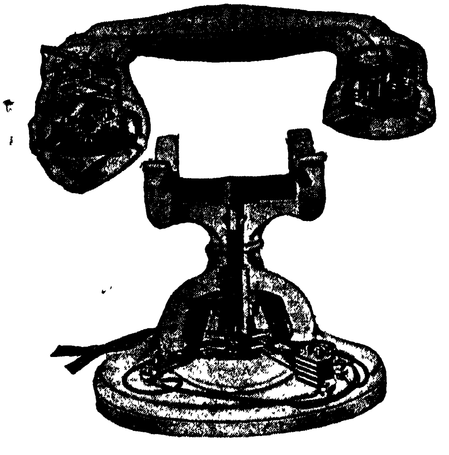
The telephone has become so much a part of our daily life that we hardly realize how much we depend upon it until we stop to think how difficult it would be to do without it. We call the doctor, the plumber, the grocer or the butcher; the business man uses it dozens of times every day; we call our friends to talk with them over our telephones. Over the wires come good news, bad news, sighs, laughter, with all the little tricks of speech by which we distinguish one voice from another. How is it done?

In the Department of Science you are told that sound is the sensation produced by certain airwaves. When a person speaks, air is set in motion; the waves beat upon the drums of the ears; the nerves of the ears report the airwaves to the brain, and the brain translates the reports into words again. But these waves spread out in every direction, growing fainter all the time, and they may be broken up by airwaves representing other sounds. Therefore, you can not hear the human voice very far away, and so we say we can not hear because of the distance or because of the noise. This means either that the waves have become too weak to make an impression, or that other waves have interfered with the speech-waves. Moreover, the sound-waves do not travel as fast as other kinds of waves. You have seen a flash of lightning and then several seconds afterward have heard the thunder; or you have seen the smoke at the mouth of a gun and have heard the report later. This is because light-waves travel much more rapidly than sound-waves.

Long ago it was found that sound-waves are carried much farther through some metals than through the air. A toy telephone was invented more than two hundred years ago, and any boy can easily make one. If you take two tin cups without bottoms, fasten a piece of parchment, or even tough paper, tightly over one end of each, make a tiny hole in the centre of each piece and stretch a wire between them, you have a telephone with which you can talk with your friend across the street, or in the next house. This simple toy will not carry the waves very far, but from a beginning like this the wonder of the telephone has come.

In 1837 Charles G. Page, of Salem, Massachusetts, had an idea that electric current might carry sound; and in 1854 a Frenchman, Charles Bourseul, suggested that speech might be carried by electricity. He did not go on with his idea, nor did a German, Johann Philipp Reis, who attempted to make an electric telephone in 1860. It did not work very well, and the difficulties seemed too great to be overcome.

In 1874 Alexander Graham Bell, a Scotsman who lived for part of the year in Boston and part in Brantford, Canada, was making experiments with sound-waves. Bell was a teacher of speech to the deaf, and his interest in the nature of sound led him to make certain experiments in electricity. He found not only that sound-waves could be shown to the eye, but that they could be changed into wave-like electric currents that could be sent over a wire. Elisha Gray, of Chicago, was working on the same idea at the same time. On February 14, 1876, Bell filed an application for a patent in Washington. Just two hours later Gray made an application for the protection of the idea.

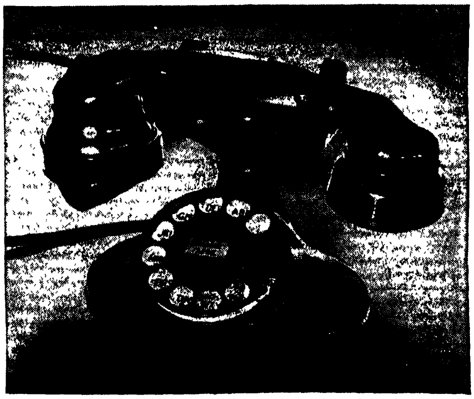


If a hand set were made of glass, this is what you would see The sound-waves from your mouth beat against a disc inside the mouthpiece, and set it vibrating against a case full of carbon grains connected to an electric wire. Waves of current corresponding to sound-waves from your mouth travel along the wire to an electromagnet perhaps many miles away. The magnet causes another disc, in an earpiece, to vibrate corresponding to the vibrations caused by your voice. So your friend "hears" you.

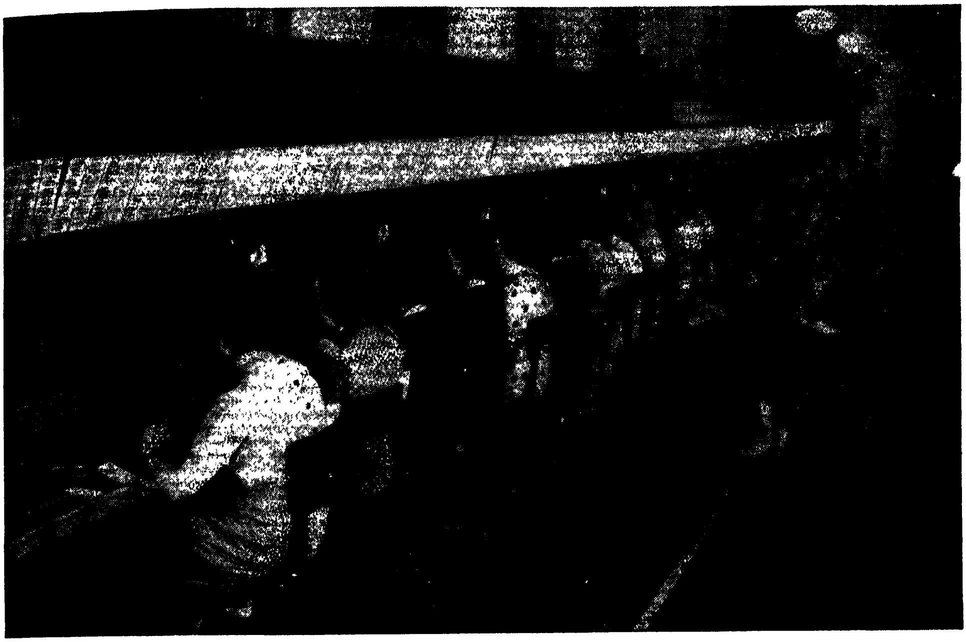
The instruments of both men were clumsy and crude. They were likely to get out of order and voices were not very distinct; but the principle was correct. The new invention made a great sensation at the Centennial Exposition in Philadelphia in 1876, but the public at first did not realize how important it was. Few people seemed to see that it was soon to become a necessity. Hundreds of improvements have been made since, and many new discoveries and inventions also. Many scientists are constantly employed. Indeed the laboratories of the Bell Telephone Company are among the largest industrial laboratories in the world.

The actual process is very simple. The sound-waves from your mouth beat upon a disc in the mouthpiece of the telephone. The disc presses against a little carbon case connected to a wire through which electric current flows. Vibrations of the disc control the amount of current which flows through the carbon, so that waves of current, corresponding to the sound-waves from your mouth, travel along the wire. Almost instantly, these waves reach an electromagnet perhaps miles away. The magnet causes another disc to vibrate and give out words to the listening ear. Your friend speaks into the mouthpiece of his telephone and the current from it moves the disc you hold to your ear and you hear the distant voice. We cannot explain this marvel. No one can tell why these vibrations should set up nerve currents which our brain transforms into words. It is all mysterious, but it is true, as you know. We may telephone to a lonely farm or to a fishing station on an island, as well as to our friends in a village or a city.

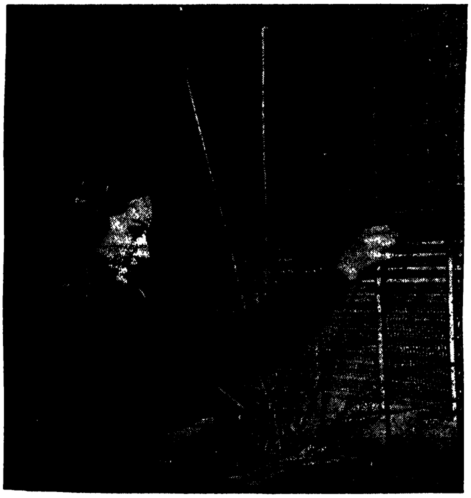
But everyone can not have separate wires running to the houses and offices of everyone else. So all the wires run to a central office, called a telephone exchange. When you wish to talk to a friend, if you don't have a dial telephone, you call up "central" by lifting your receiver from the hook, or, in a hand-ringing instrument, by turning a crank. A girl in the office answers, and when you give the number she connects the wire of your telephone to that of the telephone you are calling. In large cities, where there are many telephones, all the wires can not run into one office, so there are many central offices with such names as Chelsea, Riverside, Main and the like. Into such an office all the wires in a certain district run. If you live in a large city and wish to talk to someone who lives in a different district



Suppose you wish to call ELephant 9-4781. First lift the hand set off the cradle (the standard). Stick your finger in the E hole and bring the hole around to the right as far as it will go. Take your finger out and let the turntable swing all the way back. Do the same to the L hole. Forget the other letters. They are not used in dialing. Stick your finger in the 9 hole, swing it around as you did with the letters. Let it swing back. Do the same with the other figures. Your friend's telephone bell will ring. The connection has been made automatically, without the help of an operator.



For special attention you may dial Operator. An operator working at a switchboard will answer your call. If you wish a long-distance call, she will make the connection for you, or she will give other help if you need it. Operators continue to have an important part in telephone service, even though dial telephones are widely used. It is amazing how quickly an experienced operator can make connections on her switchboard.



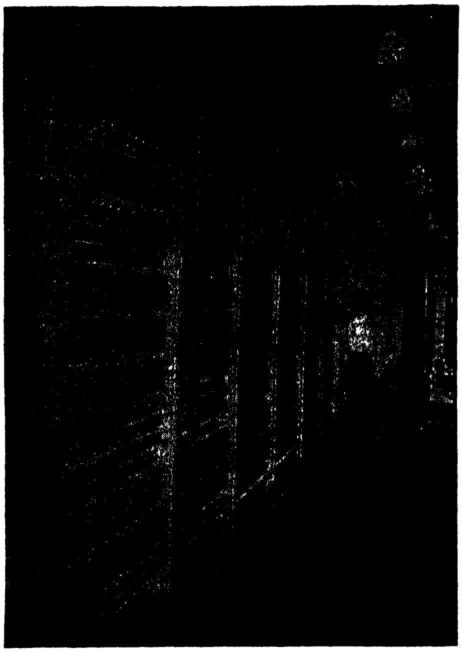
For calls between manual exchanges, two operators are needed. An A operator receives the number you wish and signals to a B operator on the exchange you are calling. B connects the two exchanges on a trunk line that is not busy. A then connects your line to the trunk; B inserts a plug into the panel in front of her, in the hole carrying the number you are calling, and your friend's telephone rings.

from yours, the telephone operator in your district asks the operator in the other district to give you your number. The same thing happens when you wish to talk to someone in another city, and ask for "Long Distance."

Sometimes it is even more complicated than this. Hotels and great business houses sometimes have dozens, even hundreds or thousands of telephones, but these are not directly connected with a central office. Since all of these telephones will not be in use at once, only a few wires connect such a building with "central." There is a private exchange which you must ask to connect you with the central office, or which asks it to give you the number you wish.

If you cannot find the name you wish in the telephone book, you may ask for "Information." In every city there is someone whose duty it is to keep track of all new subscribers whose names are not yet in the telephone book, and to give their numbers to those who inquire. Though all this seems very complicated, it is done very quickly.

Generally it is only a few seconds from the time you lift the receiver until you hear an answering voice perhaps many miles away. Of course, if your friend does not hear the bell, or does not answer promptly, you will be delayed. It is good manners to answer at once, and to speak clearly and



One type of central office equipment for dial telephoning. All connections are made by electromagnetic switches. A call through such an office is directed by what might be called an "electric brain," which does the work of both A and B operators, and does it in a fraction of a second.

distinctly, with your lips near the mouthpiece, or transmitter, as it is called. It is not necessary to shout. You should be as polite when talking over the telephone as if you were in the presence of the person to whom you are talking. Nor should you become angry with the operators. In most cases any delay is not their fault, and if everyone spoke distinctly, few wrong numbers would be called.

When Bell and his assistant, Thomas A. Watson, carried on the first telephone conversation, there were just two telephones in all the world. Now the Bell System can connect any of its telephones with nearly 23,500,000 telephones in the United States and in normal times with more than 40,000,000 telephones throughout the world. Many independent companies exist.

The wire over which Bell and Watson talked stretched only from one room to another. Now the Bell System has more than 90,000,000 miles of wire, and employs nearly 400,000 men and women. A single spoken sentence began the history of the telephone. Now this one system handles some 85,000,000 local and toll calls every day.

All these great achievements have been brought about by long years of patient study and experiment. To produce the transmitter now in general use, over one hundred types

Drawing out (spinning) wires at the high speed of 600 feet a minute for a new telephone cable.

have been designed and discarded as newer and better ones have been produced. Similarly the receiver has been improved a great many times to produce the type used to-day. There have been hundreds of other improvements in the methods and materials used in making wire and cable, in the complicated mechanism of the switchboard, in apparatus for testing the lines, and so on.

In a great many communities the dial telephone has been installed with success. The system seems rather complicated, and we can not stop to explain the exact way it works, but this is what the person making a call sees: To an ordinary instrument a dial is attached with a figure showing through each of ten holes the thickness of your finger. When you wish to call a number you remove the receiver from the hook, put your finger in the hole through which the first figure of your number shows, and rotate the dial until it stops. When you take your finger out, the dial returns to its original position. You then turn the dial for the second figure, and so on, until your number has been completed. Then the bell of the number you dialed begins to ring. Where there is more than one central office, letters also show through the holes, and you must rotate the dial for the first letters of the central office you are calling before you begin to move it for the figures. When you hang up the receiver the connection is broken.

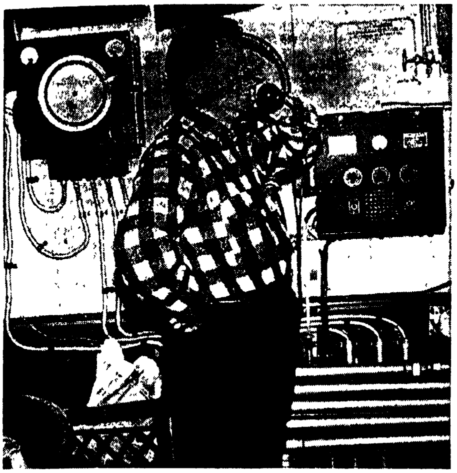
This man is splicing in a cable manhole down below the street level. Each cable is composed of scores of wires. New cables must be provided in advance to care for new subscribers. When a new instrument is installed, a wire leading from it must be connected with an unused wire in a cable leading to a central office. Each cable is labeled.

Other inventions of the telephone engineers have attracted attention because of their spectacular results, though some of these do not have much to do with regular telephone service. One of these is the telephone amplifier, or loud speaker. By means of this apparatus great crowds are enabled to hear a public speaker. Sound motion pictures are also a by-product of telephone research. So is the electrical recording of records for phonographs. Long-distance telephoning has also made great strides, and it was demonstrated some years ago that people can now talk around the world. One of the most important telephone discoveries of recent years was a method of sending many long distance conversations over a single pair of wires at the same time, without any one of the conversations interfering with any of the others.

As early as 1915 telephone engineers succeeded in sending the voice of man through space from Arlington, Virginia, to Paris, France, and on to Honolulu, Hawaiian Islands. Again in 1923 engineers talked from New York by wire and radio telephone to a group of scientists and representatives of the

A central office where overseas connections are made. Radio "bridges" are used to carry the sound over the ocean.

Programs on vast radio networks are controlled by telephone. Here is a central control room.



The captain of a fishing trawler telephones (by radio telephone) back to port, that his ship has been injured.

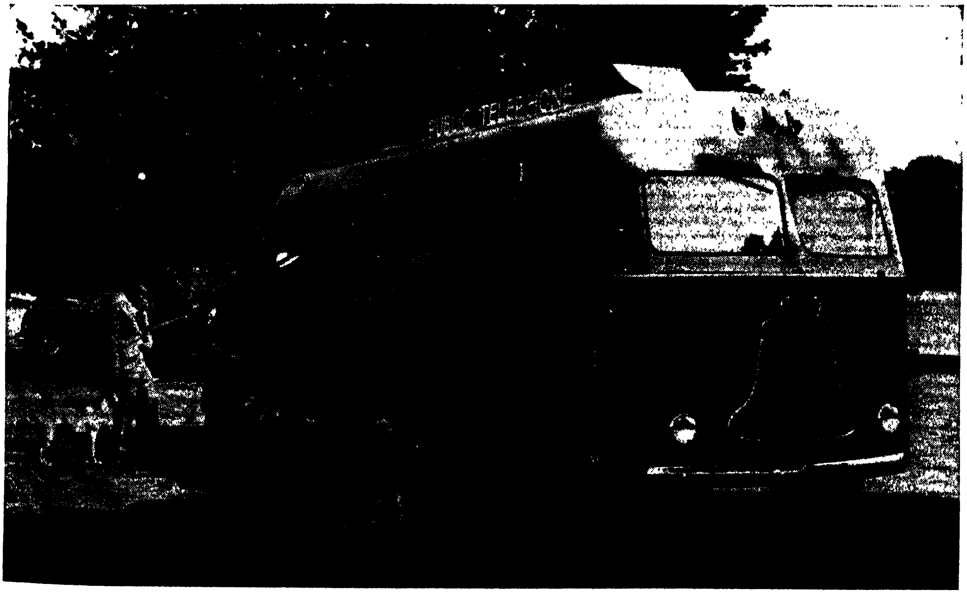
press in London, England. Since then regular transoceanic service has been started, and in normal times one can now talk to nearly all the telephone-using countries of the world. Such conversations are carried on daily. This shows how radio and the wire system can work together.

Photographs can also be sent over telephone lines. This is done every day. Radio engineers have also worked to the same end and pictures are now sent across the oceans. Network radio programs are carried by special telephone wires from the studio to the various radio stations which then put them on the air.

These are interesting and spectacular achievements of the telephone engineers. But their most important and most remarkable achievement, after all, is the construction and maintenance and operation of a system which at any time can give direct and personal communication between any two of millions of telephone users all over the world.

No other countries have so many telephones as the United States and Canada, and nowhere else is the service so quick, so cheap and so good. In most parts of Europe few private houses have telephones, while in the United States and Canada there are many towns where nearly every office or dwelling has one or more. In these countries there is a telephone for every six people. In the country districts you may see the telephone poles and wires along every road. The farmer and his family can talk with their neighbors, or with the people in the towns. Not all of these rural telephones have a separate wire for every subscriber. Several instruments are often attached to one wire, and different signals call the subscriber desired.

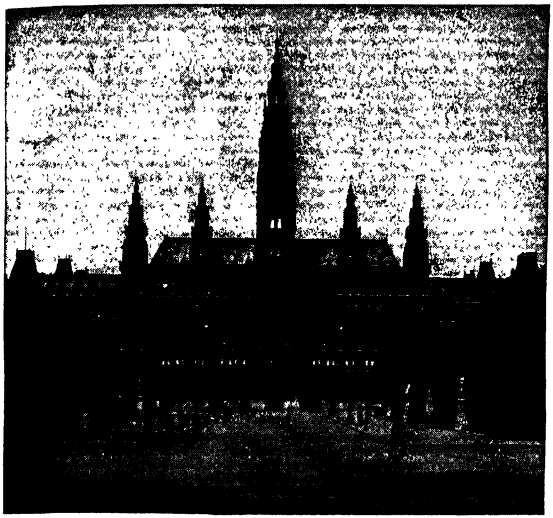
THE NEXT STORY OF FAMILIAR THINGS IS ON PAGE 6397.



A telemobile, or traveling telephone unit, with several booths. It can be rushed to temporary gatherings, as, for instance, when newspaper men flock to a scene and want to telephone their stories back to their papers.

The Hungarians of to-day are descended from fierce, cruel warriors, who swooped down upon Europe in the ninth century and ruthlessly destroyed everything in their path. After a time these Magyars, as they were called, adopted Christianity, and became the most important people in the Austrian Empire.

Although Austria joined with Prussia and Russia in 1772, to divide up the kingdom of Poland, only ninety years before Austria had been saved by the Poles from destruction. The Austrian Empire had been overrun by a Turkish army, which was on the point of capturing Vienna, when John Sobieski, the king of Poland, appeared on the scene with an army, relieved the capital, and drove the Turks out of the Austrian dominions. Here are the Polish troops with their prisoners after they had beaten the Turks.



Ewing Galloway, New York.

The Rathaus (City Hall) in Vienna is a Gothic-type structure finished in 1883. It faces Rathaus Park whose sidewalks are dotted with statues of famous Austrians.

AUSTRIA, ONCE A GREAT EMPIRE

Screen Traveler from Gendreau

The stately and beautiful Parliament Building in Greek style. It is on Vienna's famous boulevard commonly called the Ring.

IN the story of Germany we saw the immense importance of the great south-to-north highway of Europe, the Rhine. Let us now turn to the great west-and-east highway, the mighty Danube. It is twice as long as the Rhine, for there is a course of nearly two thousand miles between its source in the Black Forest and the delta on the Black Sea. Some four hundred tributaries join it on this long journey.

From the earliest times the old peoples of the world pressed out of Asia into the heart of Europe, chiefly by the great highway of the valley of the Danube. There were the old Celts, the early Teutons, and the later hordes that destroyed the old Roman Empire. The Danube was the Empire's chief boundary on the side to the north.

It was toward the end of the eighth century, when Charlemagne was steadily gathering the rule of Europe into his strong hand, that a province grew into shape on the Danube, near the end of the eastern Alps. This was the boundary of Charlemagne's empire, the eastern outpost of the German peoples forever fighting back the oncoming Slavs from the east. This province for centuries continued to be called the East Kingdom, for that is the meaning of the name Austria (Oesterreich, in German). The dominions of its rulers gradually spread over the kingdom of Bohemia and Moravia to the north, and over the mountains to a strip of country now called Galicia. Southward, too,

The Bettmann Archive

Maria Theresa, Empress of Austria, receiving with her son the Hungarian nobles. This great woman fostered many reforms in Austrian finance, agriculture and higher education. She also coped successfully with European politics.

the Austrian dominions spread, and absorbed the Tyrol, the eastern Alps and the provinces between the Danube and the Adriatic.

For six hundred years the story of Austria was the story of the Hapsburg (or Habsburg) family. When Rudolph of Hapsburg, in the thirteenth century, was chosen by the electors to head the German states as Holy Roman Emperor, few guessed the character of the man who was to do so much toward establishing the fortunes of his house. In the story of Germany we read of the extraordinary rise to power of his descendants, Maximilian, Charles V and many others, and how by conquest, treaty and marriage they gained possession of the Tyrol, the Netherlands, and Spain with its empire stretching far west across the ocean.

With some exceptions the title of Holy Roman Emperor remained with the Hapsburgs until it was finally abolished by Napoleon in 1806. During the Reformation the spread of Protestantism was opposed by the Catholic Hapsburgs. In the "religious" struggles that followed, such as the terrible Thirty Years' War (1618-48), there was far more of politics than of religion.

Over six hundred years of Hapsburg rule, from 1273 to 1918, showed these men to be often selfish and grasping rulers. But we should recall that kings and emperors elsewhere were much the same. Royal ambition, like modern nationalism, led to wars instead of peace, to conquests instead of co-operation.

To the north of Austria lies Bohemia, the country of the Czechs, whose relations with Austria were ever changing. Now Austria was subject to Bohemia, and now Bohemia was subject to Austria. Long and gallant were the struggles made by the Bohemians to preserve their liberties and their distinctive language; but the Austrians, though frequently checked, finally became stronger in their power over the country.

At last, in the Thirty Years' War, even the aid of the great Swedish king, Gustavus Adolphus, could not save the Czechs. For long years the stifling rule of Austria became fixed, so that progress and national feeling, and even language, seemed to be crushed. But not hopelessly so.

Bohemia took a brave share in the struggles for freedom that went on in Europe during the last century, and many of her hardships were removed at last. She won religious liberty, self-government, representation in Parliament at Vienna, and freedom to revive Bohemian literature and art and her mother-tongue. We tell you more about this in the story of Czechoslovakia.

Bohemia lies in the basin of the Elbe, which, like the Oder, drains to the north. By these rivers, through the encircling ring of mountains, we pass to the province of Galicia. This, too, was settled in the far past by a Slav nation, the Poles. Constant and bewildering were the changes that came to them through the centuries. About the time William of Normandy was conquering England, the Poles were forcing their way through the Carpathians and overrunning the great plains. Four hundred years later the king of Poland was chosen to be king of Bohemia.

POLAND SPREADS ITS BORDERS AND IS IN TURN SWALLOWED

When the Tudors were making themselves absolute in England, Poland was extending its borders in every direction and securing reforms of many kinds. After that it lost its independence, regained it, lost it again, and suffered much. We see it flashing out in brave deeds—as in the relief of Vienna, when it drove away the Turks; and then comes the sad story of the sharing-out of this ancient kingdom among stronger powers, Austria's share lying chiefly in the province of Galicia.

AUSTRIA GRADUALLY ABSORBED MANY STATES SOUTH OF THE DANUBE

South of the Danube other Slav peoples settled, as well as Teutons and Italians; and many states of mixed nationalities grew up and were gradually absorbed by Austria. At Innsbruck, the capital of the Tyrol, is a bronze and marble memorial of the union of Tyrol with Austria over five hundred years ago. The tomb of the emperor Maximilian is in the cathedral there, though he is buried elsewhere. But more interesting than all the reminders of kings in Innsbruck are the relics and monument of the patriot Andreas Hofer, who made such noble and determined efforts to defend his fatherland from French oppression. "It is time," he wrote on little bits of paper, and cast them to the hurrying streams to carry far and wide, and rouse the Tyrolese, ready and waiting to fly to arms at his call.

Salzburg is another famous Austrian town south of the Danube. The town of Enns gives a link with English history in the times of the Crusades. Its walls were built with the money gathered to pay the ransom of Richard I when he was captured on his way home from the Crusade.

HUNGARY, LATER ABSORBED BY AUSTRIA, WAS HER MOST IMPORTANT NEIGHBOR

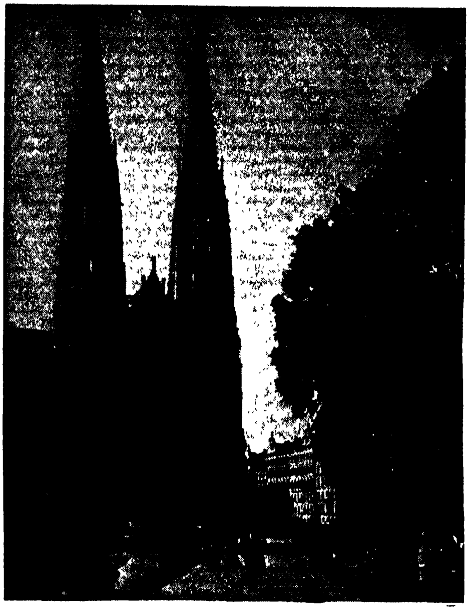
Of all the neighbors with whom Austria fought with varying success as the years rolled on, the most distinct and considerable were the Hungarians. A century after the Austrian state was formed, a people probably from Asia, the Magyars, quite different from the Teutons in stock and speech, burst through a gap in the Carpathian Mountains, swarmed down the great valley of the river Tisza, and on to the Danube, settling about its course where it makes a deep bend to the south. The kingdom of Hungary, which was thus founded, was larger than Austria. Its constitution is perhaps older than the British Constitution, and the story of its relations with Austria is one of incessant struggle to preserve its ancient freedom.

THE TURKS WERE A MENACE TO HUNGARIAN CHRISTIANITY

St. Stephen was Hungary's first king, and under him the Hungarians became a settled and civilized nation over nine hundred years ago. Stephen established the Constitution and has ever remained a national hero. Hungary has been called the "bulwark and shield of Christendom," so often did it withstand the attacks of the Mohammedan Turks. The terror of these invaders along the old Danube highway hung over Europe for centuries, as the terror of the Danes hung over England. There was a Turk's tax with which to organize resistance or pacify the invaders with bribes. Poland, Bohemia and Austria had constantly to fight them, but Hungary, owing to its position, had to bear the brunt of their raids.

In the history of Hungary, full of progress, loss, alliance with neighbors and bitter wars with them, stand out many great rulers and soldiers. One of these soldiers, John Hunyadi, fought bravely as the champion of Christianity against the Turks. But the Turks fought bitterly and ruined the country by their warfare when a prince of the House of Hapsburg was elected king of Hungary as well as of Bohemia. The Turks did not like this, and for long years the unhappy country was desolated by war.

But Austrian rule had come to stay,



Screen Traveler, from Gendreau

The Votive Church is the most beautiful edifice on Vienna's Ring. This church, completed in 1879, was the inspiration for the design of St. Patrick's Cathedral, New York City.

Screen Traveler, from Gendreau

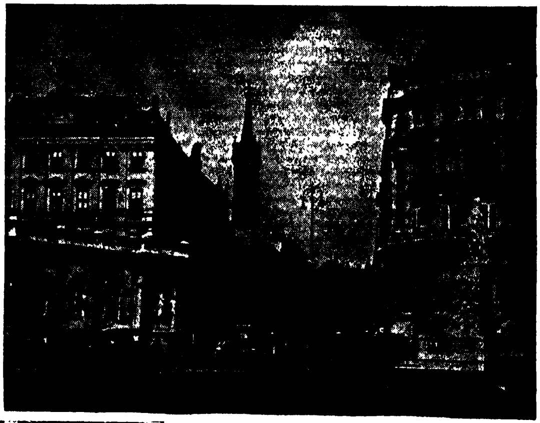
The Art and History Museum of Vienna is one of the greatest of all art galleries. Here visitors may see and enjoy a wonderful collection of treasures.

against the wishes of the Hungarians. For over three hundred years there were heavy taxes, risings of the people, and every effort was made to destroy the nationality, language and free spirit of the Hungarians. Hope revived at times, and there was a glimpse of freedom when Hungary was recognized as an independent nation when the storm of the French Revolution was about to burst. But the privileges were lost again, and it needed years of patriotic endeavor through the first half of the last century to wrest back, bit by bit, the ancient rights so long trampled under foot by the Austrians. In 1868 Francis Joseph, emperor of Austria, was crowned king of Hungary with the ancient crown of St. Stephen, after promising to govern according to the old constitution of the country. So it came to pass that the blood of the patriots was not shed in vain through the long years of struggle; for at last Hungary sat side by side, equal with Austria in the dual monarchy of the Danube.

It must be remembered that there was no united Austrian nation, no common Austrian tongue. The Empire consisted of a leading German state, Austria, broken off from the rest of the German-speaking peoples; of various states which were fragments of other nationalities, some still speaking their own languages, some more or less absorbed by their German rulers. Besides these there was the independent nationality of the Hungarians, of quite different origin from the Germans, and possessing its own speech, manners and constitution.

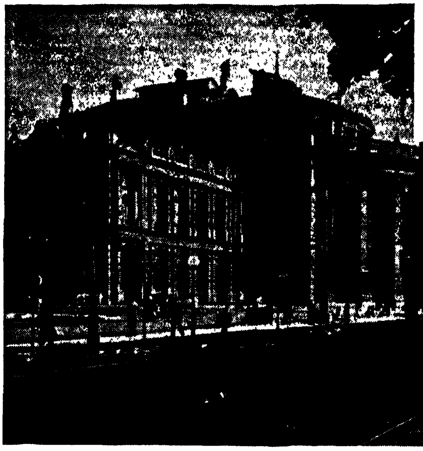
The Magyars of Hungary were united with Austria only through the king, and hostile in feeling toward the other peoples within the empire. Bohemia and Moravia, the most flourishing part of the dominions, were inhabited largely by a Czech population which gloried in its past and had never lost the hope of regaining independence. Galicia was peopled by Poles in the west and Ukranians in the east. The Transylvanian highlands of Hungary were chiefly peopled by Rumanians whose sympathy flowed toward the country of their own origin and tongue. The southern Tyrol and Kustenland were restless because their populations were Italian. All the southern provinces—Carniola, Croatia, Slavonia and Dalmatia—were filled with people of Slav origin, like the Czechs and Poles of the north. Thus Austria was far more loosely held together than any other of the countries of Europe.

Yet, instead of trying to secure greater compactness and a closer union between her parts, Austria sought to gain more lands in the direction where there was greatest danger. When the Turkish hold on the Balkan Peninsula began to slacken, Austria seized Bosnia and Herzegovina as parts of her empire, though the people were overwhelmingly Slav in stock. Little more than one-third of the people of Austria were of the German-speaking Austrian stock. Barely more than half the inhabitants of Hungary were Magyars, or native Hungarians. Thus, throughout the dual empire there was government by a minority of discontented majorities, who wished for the freedom they saw enjoyed by neighboring peoples. Three-fifths of the population of the whole empire of Austria was of Slav origin.



Screen Traveler, from Gendreau

A Platz, or open square, near the Ring. All of Vienna's great public buildings have splendor. Some are too elaborate for our modern taste. Vienna's poverty since 1919, and especially since 1940, gives the once gay city a sad appearance.

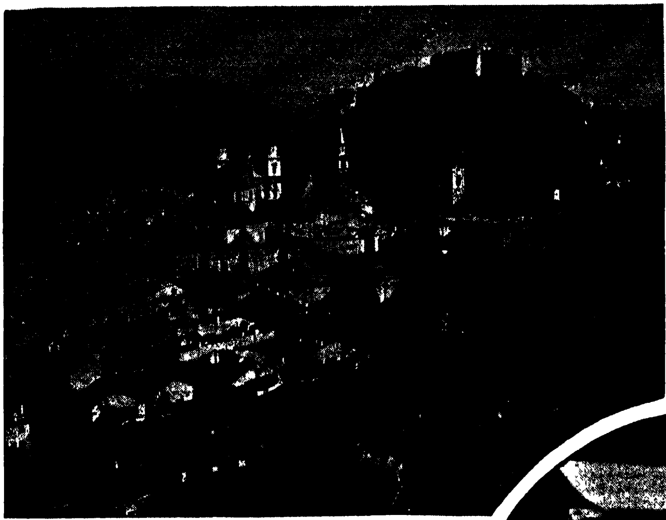


Screen Traveler, from Gendreau

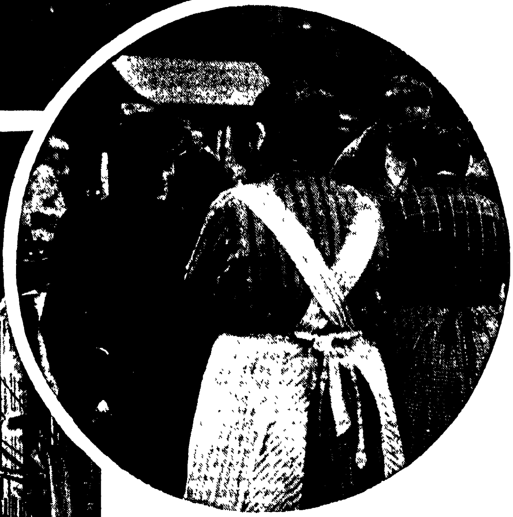
The Burg, or National, Theater is situated on Vienna's Ring, which in the above picture is in a state of repair.

Screen Traveler, from Gendreau

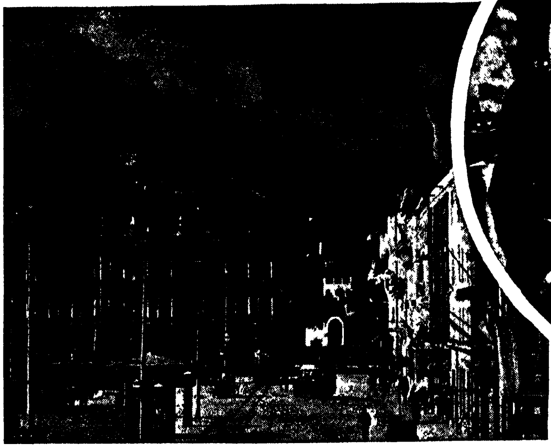
The Opera House, Vienna. Austrian music is celebrated throughout the world for its charm and beauty. Mozart, Haydn, Schubert and Strauss were all Austrians.



Three Lions, New York
A general view of Salzburg. This Austrian city has long been noted for its annual music festivals. It was the birthplace of Mozart.



Three Lions, New York
Women from around Salzburg arise early, and bring their products to sell in the city. Market-day means greeting old friends as well as business.



Philip Gendreau, New York
Square in Innsbruck, with lofty mountains behind.

These facts must be realized if we are to understand how, in the first World War, the oldest empire in Europe crumbled suddenly into pieces. When the crash of defeat came, more than twenty million Slav people—Czechs, Croats, Slovenes, Bosnians and Serbs—formed themselves into two countries, leaving Austria and Hungary proper quite small states. Yet the amazing start of the war was an attempt to crush out of existence the one free Slav country, Serbia.

The heir to the Austrian crown was murdered in the summer of 1914 when visiting Sarajevo, the capital of Bosnia. The Austrian Government fixed the blame on the neighboring country of Serbia, and imposed such heavy punishment that it was clear the murder was used only as an excuse for bringing Serbia under Austria. Germany arranged and supported these terms, for she had a treaty of alliance and defense with Austria.

Of a population of nearly fifty millions probably not half of the Austro-Hungarian people were in favor of the war, and in no direction was the Austrian fighting successful unless it was strengthened by a mixture of German troops.

The Serbians, Russians, Italians and Rumanians were all successful until German troops were drafted to the Austrian fronts. The explanation was that only the German and Hungarian peoples in Austria-Hungary had any deeply rooted sympathy with their government.

On November 3, 1918, eight days before the armistice with Germany was signed, the

Three Lions, New York

The Danube, looking north from Leopoldsburg, near Vienna. This picturesque river is the second longest in Europe. It is a highway important to several countries, and emptying into the Black Sea.

Austrians unconditionally surrendered, after four years and three months of war. Three days before, Bohemia and Moravia had joined together and proclaimed the Republic of Czechoslovakia in the north; while the southern Slavs had agreed to form with Serbia the kingdom of Yugoslavia (Southern Slavia). The young emperor Carl, who had succeeded old Francis Joseph, disappeared into private life. Austria formed a republic. Hungary became a monarchy without a king. Transylvania was annexed to the kingdom of Rumania. Later, under the terms of the Treaty of Versailles, the southern Tyrol, the peninsula of Istria and the district northward known as Kustenland were ceded to Italy. Part of Galicia passed to the Russian state of Ukrainia, and part to Poland.

These changes left the empire of Austria an entirely inland state, cut off from the sea by Yugoslavia (sometimes spelled Jugo-Slavia) and Italy, and reduced to a population of less than seven millions. Hungary, the region where the Magyar people are in a majority, now has a population of less than ten millions.

Thus, from the ruins of the Austro-Hungarian Empire rose the two considerable powers, Czechoslovakia and Yugoslavia.

Left, Gendreau; Right, Three Lions

Below, a Tyrolean cottage near Innsbruck. Right, the island castle of Franzenburg.

Rumania, to which was given Bukovina from Austria, Transylvania from Hungary, and Bessarabia from Russia, became nearly twice as large as Austria and Hungary together, and had a million more population.

How the new Austria could be supported in its poverty was a question. The population of the state was small, and raw materials for industry were scanty. There was much misery and the city of Vienna declined in population.

AUSTRIA'S MAGNIFICENT SCENERY DOES NOT SOLVE HER INDUSTRIAL PROBLEMS

Austria still had valuable mineral deposits in Styria, Carinthia and Lower Austria. She had opportunities for manufacturing, but her richest industrial districts were transferred to Czechoslovakia, and Prague grew as Vienna declined. A great deal of the country that was left her is mountainous and beautiful, as the remnant of the Tyrol around its lovely capital of Innsbruck, and the delightful Salzkammergut, a lake area inclosed by mountains, with the ancient town of Salzburg at its entrance. But these alluring mountain lands are barren, and their products do not support large populations. Of the dozen chief towns that once were Austria's proud boast only Linz on the Danube and Graz in Styria remained to keep Vienna company.

The greatest natural feature of the country, and the most helpful, is the noble Danube, which passes through the heart of the land in stately flow. It comes from Bavaria and links Vienna with the Hungarian capital of Budapest, before it reaches Belgrade, Yugoslavia's capital, then, roaring through the Iron Gates, crosses the Rumanian plain, and makes the boundary between Rumania and Bulgaria.

Once Austria was in a position to regard the Danube almost as her own. Now she is only one of the smaller partners in its usefulness to central Europe. So have the mighty fallen.

The condition of Austria after the first World War was so terrible that the sympathy of the world was drawn to her. Industry was at a standstill. Financially the country was ruined beyond recovery unless help from outside could be had. Vienna was in a state approaching famine. Her children were suffering terribly from want and disease. Their condition touched the hearts of more prosperous nations, and thousands of children were taken to other lands to recover their strength and health. Large funds were raised, and food, clothing and hospital supplies were given out by the Red Cross.

To give lasting help to a suffering people it became necessary to advance huge loans to Austria to rebuild her life. Hundreds of millions of dollars poured in from Great Britain, France, Italy and Czechoslovakia, on condition that certain financial reforms be carried out. The arranging and controlling of these loans was a triumph of the League of Nations. However, all these measures could not make Austria completely sound economically.

CONFLICTS AND SORROW IN AUSTRIA'S RECENT HISTORY

Meanwhile internal strife grew. The German Nazis became so strong in Austria that Austrian patriotism was aroused. (See Two World Wars.) The Socialists were also very strong. In 1933 Engelbert Dollfuss became chancellor, and the next year, to end the incessant party struggles, he made himself dictator. But troubles continued. Early in 1934 there were several days of bloody civil war between the Socialists and the Government. A few months later Dollfuss was assassinated by Nazis.

Austria, in 1931, had wished to unite with Germany, but union was prevented by France and Italy. Now many Austrians distrusted the German Nazis, but in 1938 Hitler invaded Austria and made it a part of the German Reich. During World War II the Allied nations declared Austria was to be independent, and it is now again free.

Though the Austrians have often been hated as rulers, yet among people who are not governed by them they are well liked. They have charming manners and none of the harshness of the Prussian character; and they have borne their misfortunes as becomes a people who once played a big part in history.

Especially does the beautiful city of Vienna, their capital, put sadness in the hearts of those who knew it in its pride. It was famous for centuries as the musical capital of the world, and was the home of the great composers Gluck, Hayden, Mozart, Beethoven, Schubert, Brahms and the two Johanns Strauss. Vienna has also been the center of Austrian art, learning and industry, a city of magnificent buildings, of pleasant living, and of natural attractions such as the Vienna Woods and the "Beautiful Blue Danube."

THE NEXT STORY OF ALL COUNTRIES IS ON PAGE 6338.

From Guillemin, Le Ciel

The star-filled sky at the horizon of Paris, France, at midnight on the twenty-first of June.

MAN *and* HIS UNIVERSE

YOU know we live in a great system of stars that we call our Galaxy, or the Milky Way System. This is disc-shaped, like a man's pocket watch or a thin biscuit. There are billions of stars in our Galaxy and its size is so great that a pulse of light would need to travel for 100,000 years to get from one edge of it to the other.

Although the Galaxy is very large, it has limits; and all around it is empty space. Our system of stars is only an island in the great ocean of space that we call the universe.

There are other islands in this great ocean. They are other stellar systems, other galaxies. They lie far off, in all directions, and in most telescopes they appear to be clouds of gas, and not swarms of stars at all. Those who first saw them through the telescopes we had a century and a half ago called them nebulae, and sometimes this term is still used. It is confusing to do so, however. It is far better to use the name nebulae when speaking of true gaseous nebulae, clouds of gas in our Galaxy lighted up by starlight. The great cloud-like masses in the far reaches of space are not nebulae, or clouds of gas; they are great systems of stars like our own and only their great distances made them look like nebulae in early telescopes.

The nearest galaxies outside our own are two irregular ones that can be seen easily with the unaided eye, if the observer is near the Equator or south of it. These are called the Magellanic Clouds, or Clouds of Magellan, in honor of the great Portuguese navigator, Fernando Magellan. They look like pieces of the Milky Way that have drifted off a little.

Only three out of every hundred galaxies outside our own are irregular ones like the Magellanic Clouds. Eighty of each hundred are spirals, like giant two-branched pinwheels. The remaining seventeen of each hundred look like cocoons, or shuttles. All of them consist of stars, however, although many of them are too far away for us to see the stars directly. We can say they are made of stars because others, that are closer to us, look exactly like them, and these nearer ones can be seen to be stars. But only by photography with great telescopes can we discern the true nature of these distant star-cities; the eye at the telescope is not powerful enough.

There is a fine spiral galaxy in the constellation Andromeda; it is about 650,000 light-years distant from us, yet we can recognize in it the same kinds of stars and gaseous nebulae and star clusters that we find in our own Galaxy. That is how we are able to determine how far away these objects are; when we find a particular kind of bright star in the Andromeda spiral, we know how bright it really is and we see how bright it appears to be, so we know how far away it must be.

No matter in what direction we look, we find these other islands in the universe. Like our cities on the earth, each one is some distance away from its neighbors on all sides and each one is most crowded at the center and thins out at the edges.

With the greatest telescopes in the world, almost 100,000,000 galaxies can be photographed! Each one, it must be remembered, consists of many thousands of millions of stars. In one of those many millions of galaxies, one of the many thousands of millions of stars is our sun. That will tell you how big you are in the universe!

Of course, we do not see all of the universe. We can describe only the part that we can see; we call that part the visible universe. Probably the part that we do not see is simply the same thing repeated endlessly.

LIGHT THAT HAS TRAVELED FOR FIVE HUNDRED MILLION YEARS

The most distant galaxies that we can detect on our photographs today are 500,000,000 light-years distant. They appear as only tiny smudges on the pictures. Light that we are now receiving from them left them before the dinosaurs came into existence! It is fossil light that has been on its way for 500,000,000 years.

The most amazing thing we find in connection with the galaxies is that they all appear to be receding from us, and those farthest away appear to be going away from us with the greatest speeds.

This is discovered by the use of the spectroscope. As the whistle of an approaching locomotive appears to be of higher pitch than the same whistle when the locomotive is traveling away from us, so light changes if the source of light is coming toward us or going away from us. This is called the Doppler effect, from the name of the man who brought it to the world's attention.

Using the spectroscope, we find that a star whose distance is increasing displays a certain effect. For a star whose distance is diminishing, the effect is in the opposite direction. From a study of these effects we learn how fast the distance is changing.

You will notice that we are careful to say that the distance of the star is increasing or diminishing, and not that the star is going away from us or coming toward us. Sometimes a star which is not moving at all will appear to be coming toward us, because we are going toward it. The earth revolves around the sun, and our motion shows up when we try to measure the motions of the stars. We must always subtract our motion to find how fast the star is really moving.

WHAT IS MEANT BY THE TERM "EXPANDING UNIVERSE"

The distant galaxies all appear to be receding from us; even more interesting is the fact that the farther away a galaxy is the faster it appears to be going away from us. It is as though all other things in the universe were trying to get away from our solar system as fast as possible!

This appearance gave rise to the expression, the "expanding universe," for which there were several different explanations put forth some years ago. One of the simplest ways of looking at this problem is to say: The galaxies that have been moving fastest have been able to get farthest away from us. This may not be the correct answer, but today, we must confess, we do not know what the correct answer is.

There is a growing suspicion that perhaps the galaxies are not really receding. Perhaps what we thought was the Doppler effect is something else. Perhaps, even, it is something so far outside our present knowledge that we have no way of including it in our other theories. One suggestion is that the effect we observe is evidence that light can not travel forever and ever without getting tired. If a pulse of light is forced to travel for millions of years, it may lose so much energy that we can see the effect; the farther the light has to travel, the greater the effect.

Many people who read or hear about this picture of the universe—great galaxies of stars stretching to endless distances in all directions—begin to feel small and insignificant. They say to each other, "Man does not amount to very much, does he?"

This is a very common reaction, but it is not a worthy one. We should think of man

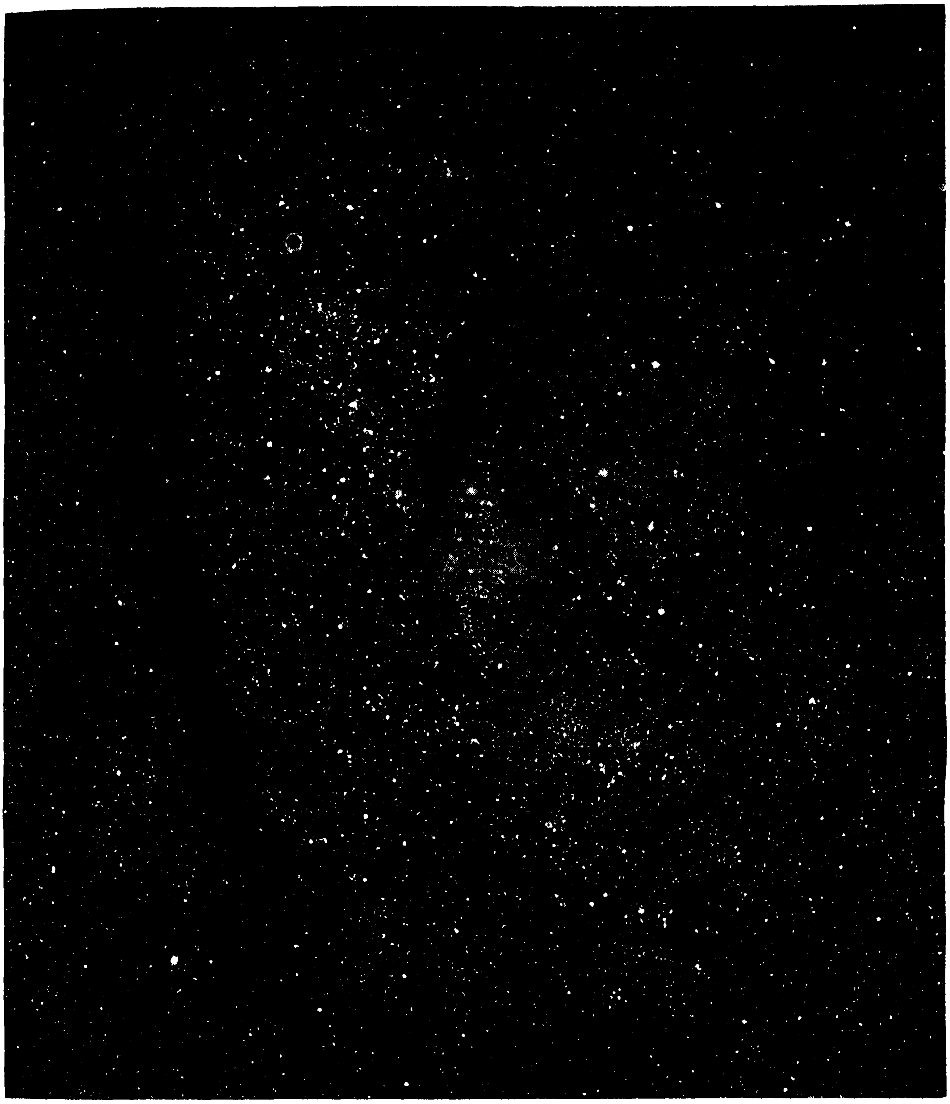


Photo from Cook Observatory, University of Pennsylvania

Some of the billions of stars in the Milky Way, the galaxy, or system of stars, in which our own planet moves.

as the creature that must ride on his little planet, with only one way of receiving signals from outside his own Galaxy—only one sense organ—sight—to use on the problem of discovering what kind of universe he lives in. (Only waves of light reach us from the rest of the universe.) Despite this handicap, man has devised methods and has built instruments by which he has discovered how hot the stars are, how big they are, what they are made of, how fast they travel and all the other strange and wonderful things we know about them. Man has even been able to make contact with the moon by means of radar. Surely it is no insignificant creature that has been able to do this; only a very wonderful creature would even want to learn these things. In all this great and fine universe of ours, the most remarkable thing is the mind of man.

By Roy K. Marshall.

THE NEXT STORY OF THE EARTH IS ON PAGE 6363.

CHEMICAL CYCLES IN NATURE

ALL plants and animals are made up of cells and of substances that have been secreted by cells. These cells contain combinations of a number of chemical elements. The most important of these elements are carbon, hydrogen, oxygen and nitrogen, all very common in nature. For example, water is made up of the two elements, hydrogen and oxygen. We also know that the air about us is a mixture of gases, which includes free nitrogen, free oxygen and a combination of carbon and oxygen, carbon dioxide.

Since they are found on every hand, we may be inclined to take oxygen, carbon, hydrogen and nitrogen more or less for granted. Yet we should not, for they are the elements that make up the bulk of living substance in cells—they represent the riddle of life. The living substance in cells is known as protoplasm. Now the chemical elements of protoplasm are in no way unique—they are found in non-living things also. It is the special way in which these elements are combined that makes living substance different from non-living substances.

The elements in living substances are arranged in the form of several compounds. Chief among these are carbohydrates, water, fats and proteins. We generally think of such compounds as things to eat and drink. So they are, for we are eaters of protoplasm, and we raise this living substance in the form of various plants and animals in order that we may be nourished.

Carbohydrates contain the elements carbon, oxygen and hydrogen, with the hydrogen and oxygen usually in the ratio of two parts hydrogen to one part oxygen. Fats or plant oils contain hydrogen, oxygen and carbon also, but the ratio of two hydrogens to one oxygen is not in evidence.

Proteins, of which there are many different types, contain hydrogen, oxygen, carbon and, in addition, the element nitrogen. Proteins usually contain small amounts of other elements—sulfur, phosphorus, magnesium and iron, in varying quantities.

It is from carbohydrates, fats and proteins that we get the food materials needed for making new cells (growth), for the repair of cells, and for the energy that we use in work or play. When you move a finger even

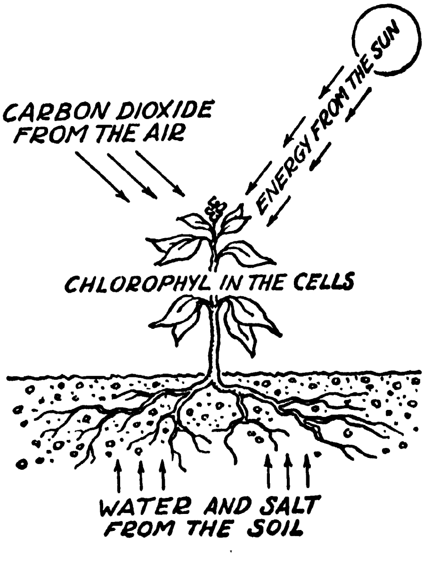
slightly, the substance of many muscle cells is partly consumed. To be sure, the loss is slight, but sooner or later the protoplasm that has been used up must be replaced; in fact, entire cells may have to be replaced because they have become worn out. New supplies of carbohydrates, fats and proteins must be provided for such repairs, because the body can not make them from nothing.

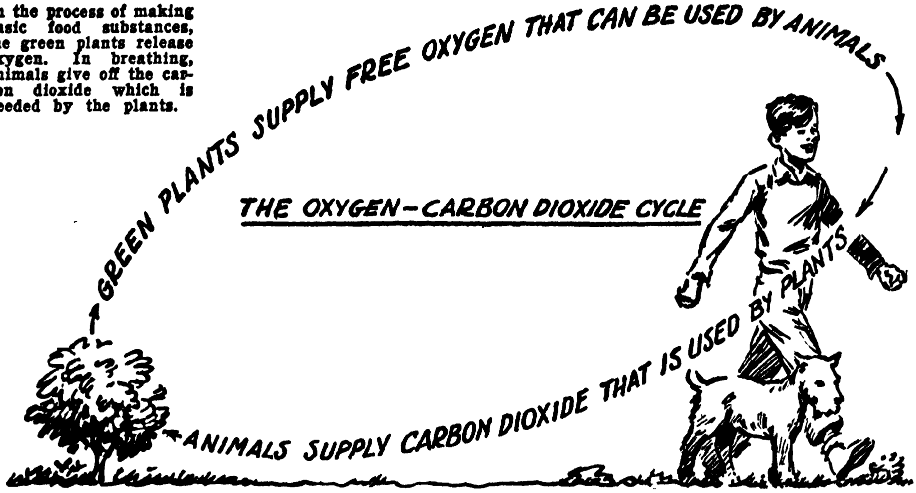
The story of growth and repair really begins with the green plant growing in the sunshine. The plant roots absorb water and salts from the soil. Carbon dioxide of the air enters through tiny openings in the leaves. The water and salts from the soil, entering through the roots, are pushed and pulled up in the plant until they enter the leaves. Within the green cells of the leaves a very important change now takes place. Each cell becomes a sort of factory. The power to run the factory is the energy of sunlight. The machinery is the green coloring matter in the cells, chlorophyl. The factories break down the carbon dioxide and the water and form new compounds. This factory work is called photosynthesis (building by means of light). We do not yet understand the process; but we know this—if photosynthesis is to take place, sunlight is needed, and also chlorophyl, and, of course, the materials carbon, oxygen and hydrogen. Each cell factory takes carbon dioxide and water, and produces simple sugar and free oxygen. The simple sugar so formed is the basic food to which green plants and almost all other living things owe their being.

Simple sugar is a carbohydrate. Green plants are able to change this into other substances, including oils and proteins. This is something that can not be done in the animal body, so in a very real way, all animals, including ourselves, are dependent upon the green plants. Even the beefsteak or roast lamb that we eat came into being because green plants first made the basic foods, which were then eaten by cattle and sheep, and rearranged to form the cells of meat.

The green plants make the basic food substances, and while they are about it, they release a certain amount of free oxygen to the air. Animals, as everyone knows, must have oxygen in order to live, and for that matter, so must plants. The oxygen combines with living substance in cells to release the energy that is used in doing work. When energy is set free in an animal cell, carbon dioxide is formed as one waste product. Hence, green plants supply free oxygen that can be used by animals; and animals supply carbon dioxide that is used by green plants. Sometimes this exchange is called the "oxygen-carbon dioxide cycle."

As we have said, proteins contain nitrogen, in addition to carbon, oxygen and hydrogen; and proteins are a very necessary part of all




GREEN PLANTS SUPPLY FREE OXYGEN THAT CAN BE USED BY ANIMALS
THE OXYGEN-CARBON DIOXIDE CYCLE
ANIMALS SUPPLY CARBON DIOXIDE THAT IS USED BY PLANTS

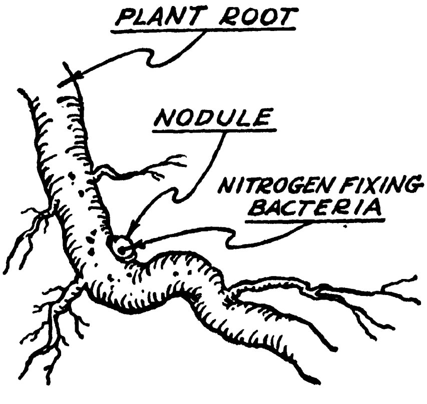
In the process of making basic food substances, the green plants release oxygen. In breathing, animals give off the carbon dioxide which is needed by the plants.

living substances. How, then, do green plants get the nitrogen that they must have in order to make proteins? You might guess that they would get nitrogen directly from the air. The story is not so simple as that, because green plants are unable to use the air's nitrogen, even though it is all about them. What we find is that the nitrogen available to living things has its origin with certain tiny organisms, which are part of the group known as bacteria.

When a plant or animal dies, its body is soon attacked by the so-called bacteria of decay. These little organisms feed upon the dead tissues and break them down into simpler compounds. One of these compounds is ammonia, and ammonia contains nitrogen. Other bacteria that live in the soil use ammonia to make a number of nitrogen compounds, including some that are called nitrates. Now green plants can absorb and use nitrates to build their proteins. Hence, some of the nitrogen in dead bodies eventually is returned to the green plant world, after it has been worked upon by several types of bacteria.

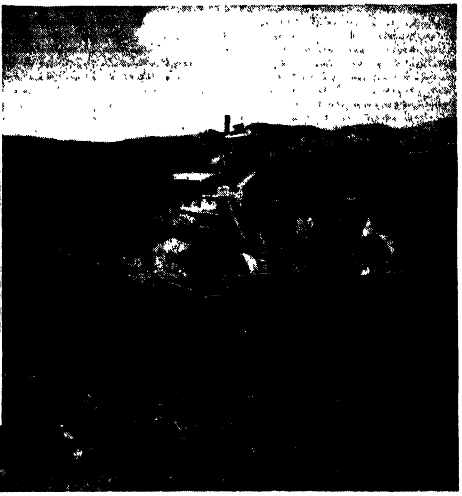
However, if the nitrogen that gets into the soil from dead bodies were all that was available to green plants, the supply would sooner or later become much reduced; and life as we know it on this planet would cease to exist. When plant and animal bodies decay, not all the nitrogen in them goes into the soil. Some of it is set free and returns to the air. Fortunately, there is another group of bacteria which aids us, in a curious way. These bacteria are called the nitrogen-fixing bacteria, and many of them live upon the roots of such crop plants as peas, beans, clover and alfalfa. The bacteria work their way into the outer tissue of the roots. The roots then form little warty growths that are called nodules. The nitrogen-fixing bacteria within a nodule take free nitrogen from the air, and make ammonia. This they use in forming their own proteins. When the nitrogen-fixing bacteria die, other soil bacteria change their decaying proteins into nitrates. Then green plants absorb and use the nitrates.

You can now see why many farmers plant crops of alfalfa, clover and soybeans every few years. They know that corn, for example, will drain nitrates from the soil at a steady pace, and that a field planted to corn year after year will soon become "worn out." But if plants which develop colonies of nitrogen-fixing bacteria are grown during some years, the supply of nitrates in the soil will



De Cou from Ewing Galloway, N. Y.

Part of a large nitrate plant. Nature itself produces nitrates, but sometimes we use factory products to help build up worn-out soil.



Courtesy, Caterpillar Tractor Company

Plowing under a crop. The plants decay, and the nitrogen on the roots is turned into nitrates.

be renewed, and other crops can be grown once more. A very common custom is to plant a field with alfalfa, or another of these special crops. When the crop is well grown, the farmer plows the field, crop and all, turning a furrow of earth over the green crop (plowing it under). The plants die and decay and the nitrogen in the nodules on the roots is changed into nitrates. A crop grown thus to enrich the soil is called a green manure, or a cover crop.

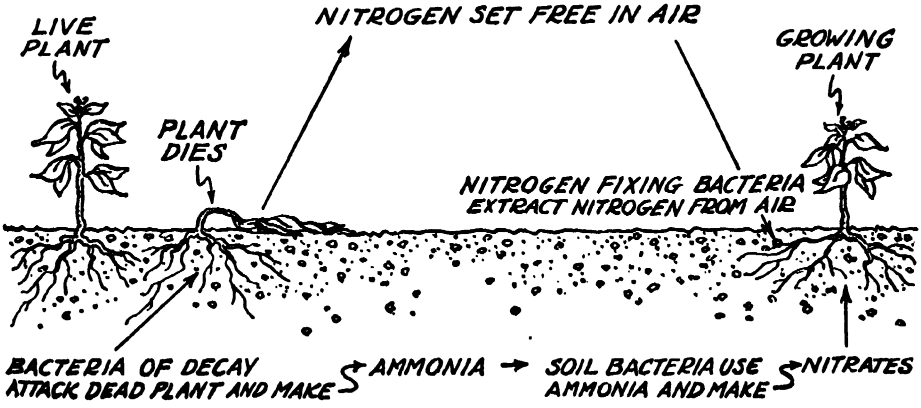
We have learned to make nitrates in our factories, and we sometimes use these factory products to build up worn-out soils. For the most part, however, we continue to depend upon the little soil bacteria to do the work for us.

We can see then, that there is a very important nitrogen cycle in nature. Free nitrogen exists in the air, and nitrogen compounds are found in the bodies of all plants and animals. These nitrogen compounds are the food substances that we call proteins. We, being animals, get our supplies of proteins by eating green plants, or by eating other animals that feed upon green plants.

By F. L. FITZPATRICK.

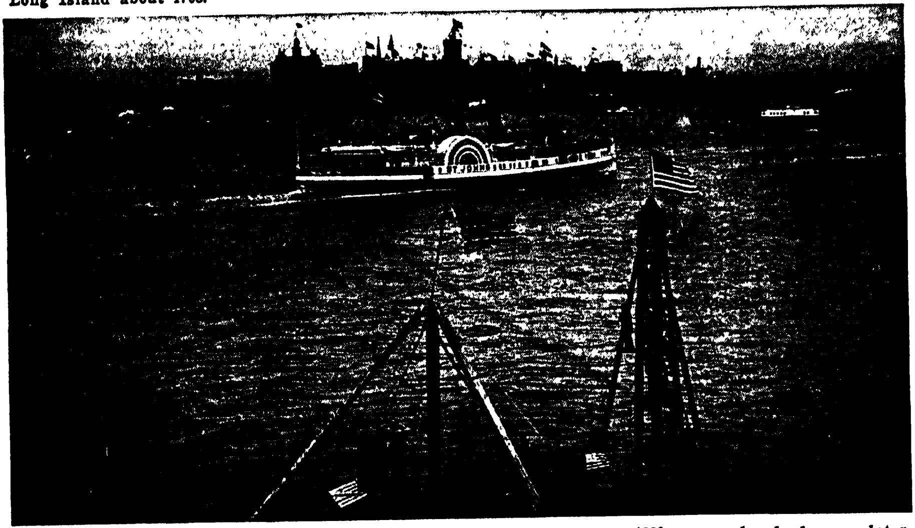
THE NEXT STORY OF SCIENCE IS ON PAGE 6283.

THE NITROGEN CYCLE

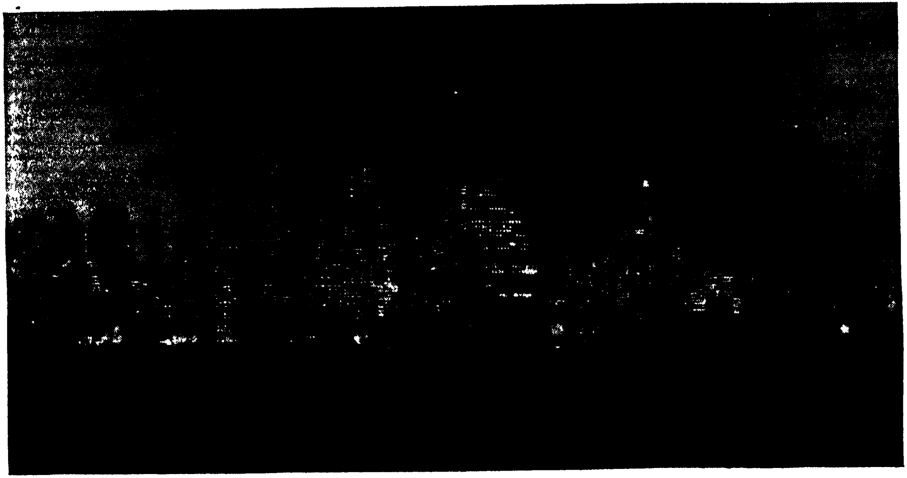

LIVE PLANT
NITROGEN SET FREE IN AIR
GROWING PLANT
PLANT DIES
NITROGEN FIXING BACTERIA EXTRACT NITROGEN FROM AIR
BACTERIA OF DECAY ATTACK DEAD PLANT AND MAKE
AMMONIA
SOIL BACTERIA USE AMMONIA AND MAKE
NITRATES

THE CHANGING SKY-LINE OF NEW YORK

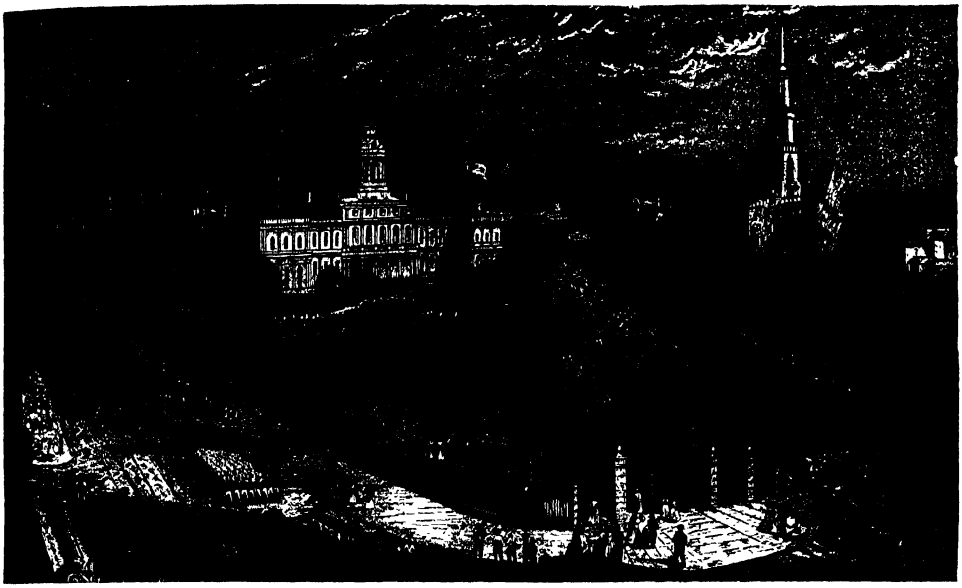
This view made from an old print shows how the tip end of Manhattan Island appeared when viewed from Long Island about 1768.



This view of the same section of the city was taken from the water in 1889, over a hundred years later than the one above.
Photo by Elmendorf, from Ewing Galloway



This striking view shows the new skyline of lower Manhattan, as seen from Brooklyn at night. The three tall buildings in the centre are, from left to right, the City Bank Farmers Trust Building (59 stories), the Bank of Manhattan Building (65 stories) and the Cities Service Building (67 stories). They are among the highest buildings in the world and seem to dwarf the Woolworth Building, which may be seen in the right middle distance with a light at its tip.
Photo, R. I. Nesmith and Associates



City Hall in the 1850's. Note the horse-drawn bus, and the soldiers marching down Broadway.

WHAT ONE MAY SEE IN NEW YORK

MOST Americans, and nearly all foreigners, when they speak of the city of New York, have in mind the island of Manhattan, which lies between the Hudson and the East River. It was down at the tip of this island that the tiny trading post of Nieuw Amsterdam was founded by the Dutch in 1626. From this small beginning the city grew northward until it filled the island and spread over Bronx County on the mainland to the north, and Long Island to the east. In 1898 the city received a new charter from the state, according to which the City of New York consists of five boroughs, each one of which is a county. These are the Borough and County of the Bronx, the Borough and County of Queens in Long Island, the Borough of Brooklyn, Kings County, Long Island, the Borough and County of Richmond, Staten Island, and the Borough of Manhattan, New York County, Manhattan Island. The area of the city is now 322 square miles, and the population more than seven millions.

The Bronx, on the mainland, separated from upper Manhattan by Harlem River and Spuyten Duyvil Creek, is larger than Manhattan. It was named for Jonas Bronck, a Scandinavian, who was the first white settler. Brooklyn is a city in itself; in fact, in 1898, when it was made a part of New York, it was the fourth largest city in the United States. All of the boroughs have swallowed up dozens of little towns and villages as they grew and spread, but nowhere is this so clearly seen as in the sparsely populated Borough of Richmond, or Staten Island. Here the villages have not yet been obliterated by solidly built-up city streets, but remain scattered over the island, separated by open country. It is very strange to think that these rural scenes are really a part of the biggest city in the world.

Although it is rather like the tail wagging the dog, little Manhattan is still the most important part of the city. It is here that the chief financial business of the city is carried on, here its great public offices are to be found, and here is one of the world's greatest trade centres. It is the capital of the entertainment world, and music and art have their headquarters here.

There are several ways by which we may enter this famous city, all of them interesting. We may come into the heart of the city through either of the two great railway stations, or we may cross the river from the New Jersey shore, by ferry or through one of the vehicular tunnels. We may come down Long Island Sound in a coastwise steamer, land from a plane at the city airport, La Guardia Field, or, best of all, if we are coming in from the sea, we shall sail up the Lower Bay, through the Narrows, across the beautiful land-locked Upper Bay, and up the mouth of the river, to tie up at one of the Hudson River piers. As we come up the bay we are struck by the great beauty of the harbor and by the wonderful sky line made by the tall buildings in the lower part of the city. If we sail in through the Narrows when the waters of the bay and Bartholdi's great Statue of Liberty are lighted up by the setting sun, the towers on the waterfront seem to stretch up into the glow above them. Perhaps we may cross the river at dusk, or in the velvety darkness of a summer evening, and if we look up to the tops of the towering buildings as we approach them, and measure them with the lighted ferry boats that glide past us, we may gain some idea of their height.

TOWERS THAT ALMOST SEEM TO TOUCH THE SKY

Some of these tall buildings are very famous. The Woolworth Building, of which you will find a picture on page 6688, is over 790 feet high. The figure on the top of the Municipal Building stands over 550 feet above the street. The Manhattan Company Building is 927 feet high. Farther uptown is the Chrysler Building, 1,046 feet from the pavement to the tip of its needle spire; and the Empire State Building, the tallest of all, 1,248 feet.

THE EBB AND FLOW OF HUMANITY IN THE NARROW STREETS

Many of the buildings hold thousands of office workers, and at midday, when they pour out to luncheon, the high, canyon-like walls of the downtown section look down on a wonderful sight. Crowds of men and women surge to and fro in the narrow streets of this old part of the city. At any time between noon and two o'clock Nassau Street is crowded from wall to wall with an endless procession. In the evening, when the crowds have been carried away by subway train, or bus, or ferry to their homes in the upper part of the city, in Brooklyn or some place on Long Island or Staten Island, or in New Jersey, all these buildings are deserted. Then the empty streets look more than ever like canyons, and the walls of the deserted edifices send back hollow echoes to the footsteps of the solitary watchman as he makes his rounds to see that all is secure.

Erected at different times since the first decade of the present century, these buildings show clearly the changes in skyscraper design and decoration that have taken place during this period. The older buildings have elaborate carvings, metal grillwork and other decorations. The newer ones have very little applied ornamentation and rely on grace of line and proportion for much of their beauty.

BOWLING GREEN, THE CITY'S OLDEST PUBLIC PARK

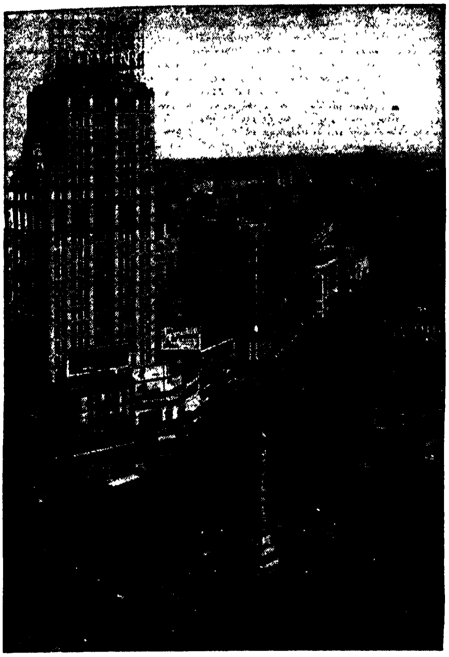
Of course all of the buildings are not so tall as those of which we have spoken. Most of them are of moderate height, and some of the finest are only a few stories high. The Custom House, a square granite building, is an impressive example of the Neoclassic style, a little heavy, but handsome and dignified. Nearly a third of the foreign commerce of the United States passes through the port of New York, and it is fitting that the New York headquarters of the customs department should have such a fine building. It stands on part of the ground on which the old Dutch Fort Amsterdam was built, and in front of it is Bowling Green, where New Yorkers of long ago played at bowls. The statue of King George III, which once stood in the centre of the green, was, as we know, melted down for bullets for the Revolutionary army, and a statue of Abraham de Peyster, an early mayor of New York, has taken its place. The old iron railing remains, but the crowns that topped the fence pickets were broken off during the Revolution.

WALL STREET, WHERE OUR FIRST PRESIDENT WAS INAUGURATED

Near Broadway, on Wall Street, which received its name from the wall of Nieuw Amsterdam, stands the Subtreasury building, an immensely strong, fortress-like building in the form of a Greek temple. It is an interesting and important building, but we cannot help regretting that it was not built elsewhere. To make room for it, Federal Hall, in which the first Congress of the United States assembled, and in front of which the first president took his oath of office, was torn down. A statue of George Washington by J. Q. A. Ward stands in front of the building.

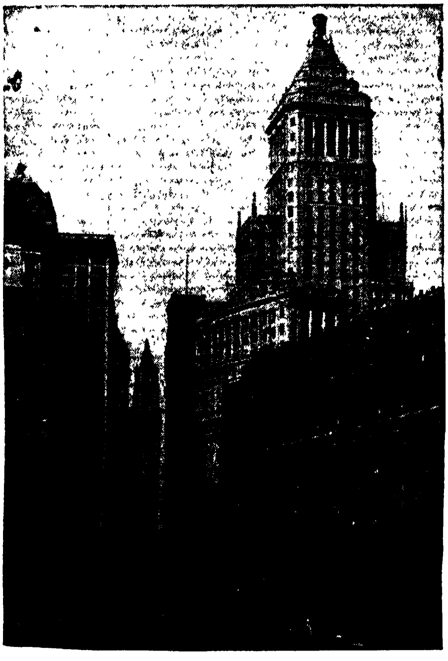
Within a stone's throw of the Subtreasury is the New York Stock Exchange, one of the great stock markets of the world. Visitors may be taken by members of the Exchange to look down from the gallery on the hubbub made by the buyers and sellers of stocks on

BOWLING GREEN TO CENTRAL PARK

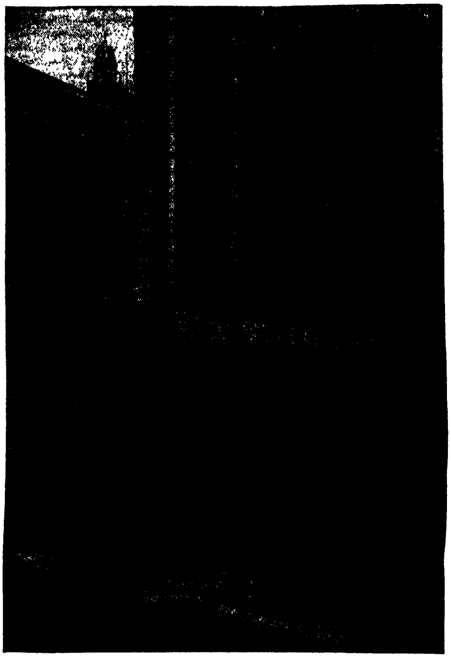


This is the southwest corner of Central Park, Columbus Circle at Eighth Avenue, showing the statue of Columbus on its high column.

This is the southeast corner, looking toward the Plaza, 59th St. at Fifth Ave., with the Sherry-Netherland, Savoy Plaza and Squibb Buildings.



From Battery Park Broadway stretches like a canyon. On the right is the Custom House, with the Standard Oil Building beyond.



Hemmed in on all sides by high buildings, Trinity Church and Graveyard still remain on the original site. Alexander Hamilton is buried here.

Upper right photo, R. I. Nesmith and Associates; others, Ewing Galloway the floor below, especially on days when trading is active. On Liberty Street is the Chamber of Commerce, and nearby, on Cedar Street, is the Clearing House, where the great banks transact their business with one another. This whole financial district is known throughout the world as "Wall Street," from the name of its principal thoroughfare.

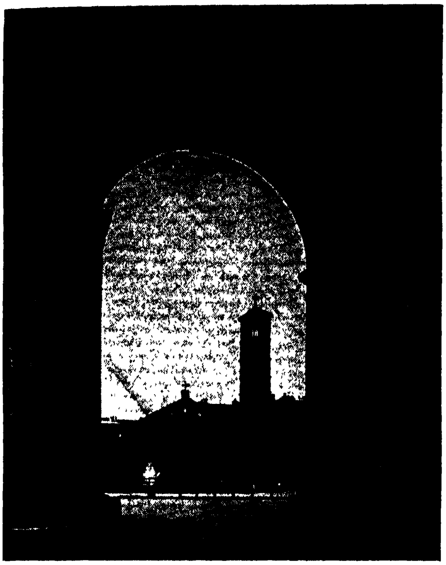
The centre of the city government is not far off, where the City Hall is set in a small park which keeps it apart from the noise and clangor of the streets. Completed in 1811, City Hall is a serenely beautiful building of white marble, showing French Renaissance and American Colonial influences in its architecture. The mayor has his office in the building; the Board of Estimate holds its meetings there; and distinguished visitors to the city, or homecoming heroes, are welcomed there. The Governor's Suite on the second floor has been made into a museum containing, among other things, a writing table used by George Washington and many portraits by some of the better known of the earlier painters of the United States.

The Hall of Records, in which all of the legal records of Manhattan are kept, is just across the corner, and close by is the tall Municipal Building, in which most of the city offices are located. This building is placed right across Chambers Street, and the traffic runs through great arches in the building. To the north of the Municipal Building is Foley Square, surrounded by various Federal, State and City governmental buildings, and dominated by the thirty-two story tower of the United States Court House.

In the lower part of the city the streets are irregular, and all of them have names; but farther north the city is laid out in regular oblong blocks: the numbered streets run east and west across the island, and the avenues run north and south, which makes it easy even for a stranger to find his way about. The shape of the city is so irregu-

Courtesy, New York City WPA Art Project

The corner of Wall and Broad Streets. The low building at the left is the J. P. Morgan bank, and across from it, facing Broad Street, is the New York Stock Exchange. The statue of Washington stands on the steps of the Subtreasury, and at the extreme right we catch a glimpse of old Trinity Church, on Broadway, where Wall Street ends.



© Ewing Galloway, N. Y.

The Washington Arch stands in Washington Square at the foot of Fifth Avenue. The statues on the arch show Washington as a soldier and as a civilian.

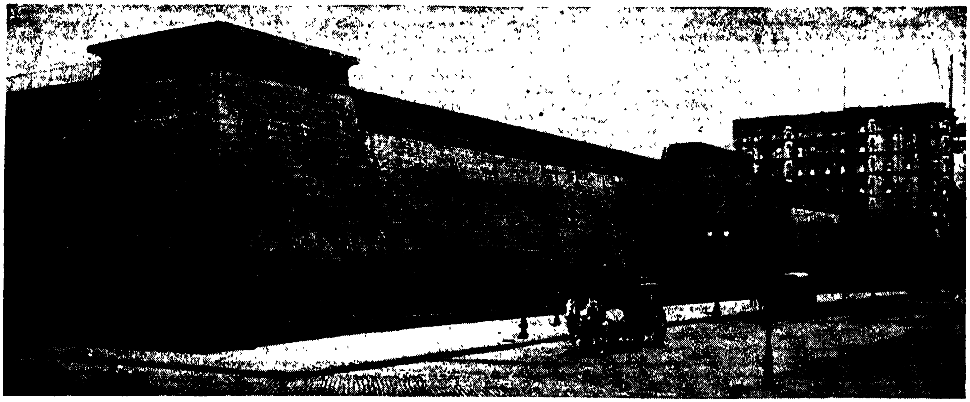
lar, however, that Broadway is the only street that runs through it from one end to the other. Along the first part of its course this famous street runs straight, but about two and a half miles from its beginning it makes a sudden turn, and on its wandering way toward the Hudson, from Tenth Street to 108th Street, it crosses every one of the north-and-south bound avenues from Fifth Avenue westward. This leaves odd triangular spaces and irregularly shaped "squares," which make welcome breathing spaces in the crowded city.

Madison Square, the first of these crossings, is a real park, three blocks long and almost as wide. Here we see the graceful clock tower of the Metropolitan Life Insurance Building, with its sweet-toned chimes that mark the passing of the hours. Across from the park, on the narrow triangle where Broadway and Fifth Avenue come together, stands the curiously shaped Flatiron Building, long a famous landmark in the city. Farther north, where Broadway crosses Sixth Avenue, there are two triangular parks, one called Greeley Square, from the statue of Horace Greeley that stands in the centre, and the other called Herald Square, because the New York Herald used to be located there. These are surrounded by immense department stores and hotels.

Times Square, where Broadway crosses Seventh Avenue, takes its name from the offices of the New York Times. This is the heart of the theatre district, and it has many hotels and restaurants. At night it blazes with many-colored electric signs and crowds of entertainment seekers surge through it. The building of the New York Times, which fills the southern triangle, has a news bulletin in electric lights which moves continuously round the four sides of the building. There are always people standing to watch the news headlines as they travel by, and on election nights, or when any stirring events are taking place, it is sometimes impossible to get through the crowds of watchers in the street.

At 59th Street, where Broadway crosses Eighth Avenue, is Columbus Circle. Here traffic flows unceasingly round the base of the seventy-foot column that supports a statue of Columbus. There are tall buildings in the western arc of the Circle, and on the northeast is the Merchant's Gate to Central Park and the monument to the men who lost their lives on the Battleship Maine, just before the Spanish-American War. After it leaves Columbus Circle, Broadway is wide enough to have a park-strip with shrubbery and benches in the centre. At 116th Street Broadway passes through the campus of Columbia University, one of the oldest and largest of American universities. In the upper part of the city the street runs between rows of modern apartment houses.

Fifth Avenue, the dividing line of the city, is difficult to describe. The life of this beautiful and famous street is like an abstract of the changing life of the city. Not many years ago it was quite given up to the houses of wealthy people. But business places began to creep in and now much of it is a great shopping district. It begins at Washington Square, and for a few blocks it is a charming residential section. Then, for quite a stretch, one finds many publishing houses, importing companies and wholesale establishments. At Thirty-fourth Street it passes the Empire State Building, and from here up to Central Park, at Sixtieth Street, there are fine shops. The Public Library is at Forty-second Street, and St. Patrick's Cathedral and the entrance to Rockefeller Center are opposite each other at Fiftieth Street. At Fifty-eighth Street the Avenue passes the tree-bordered Plaza, with the famous Pulitzer fountain and the gilded equestrian statue of General Sherman by Augustus Saint Gaudens. This square is surrounded on three sides by towering hotel buildings and fashionable shops, and at the north end is the entrance to Central Park.



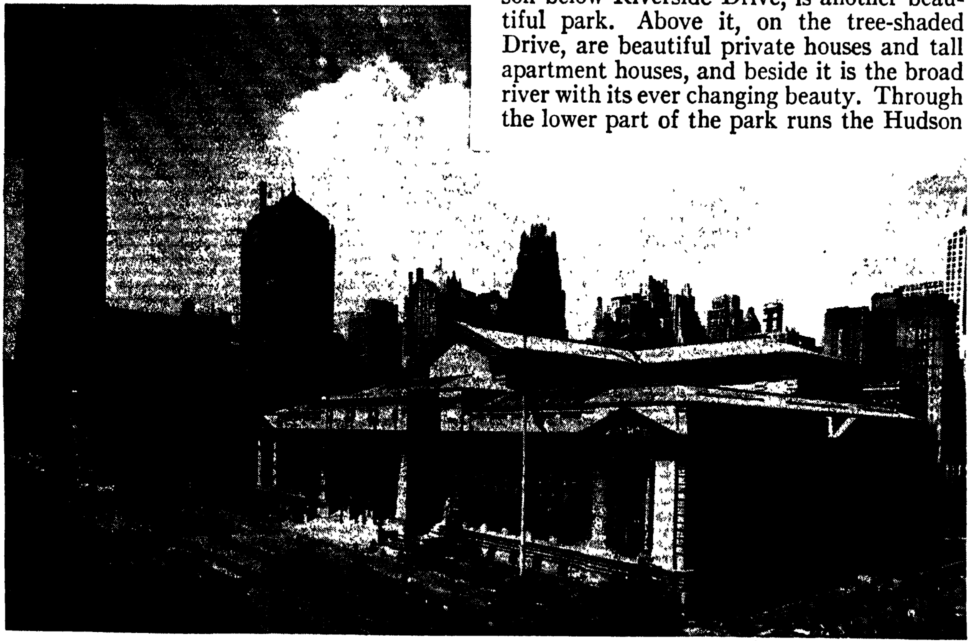
© Ewing Galloway, N. Y.

Fifth Avenue between 40th and 42nd Streets as it was in the 1890's, when the massive walls of the Croton Reservoir stood there. Water was brought to this reservoir from the Croton River, many miles above the city.

Fifth Avenue now becomes a residential street again, with the green park on one side and apartment buildings and private houses on the other. At 110th Street, where the Park ends, the Avenue suddenly becomes a shabby, tawdry street and so remains, until its end at the Harlem River.

When people who live in Manhattan speak of "The Park" they mean Central Park. Situated in the heart of the city, it is an oblong two and a half miles long by nearly half a mile wide. Within its boundaries are winding roads and paths, rocky places, lakes and woods, fountains and open lawns, tennis courts and playgrounds, flower gardens and a small, well-kept zoo, with a delightful open-air restaurant nearby. At 82nd Street, on the Fifth Avenue side, is the Metropolitan Museum of Art, and almost directly across the park, on Central Park West, is the Museum of Natural History.

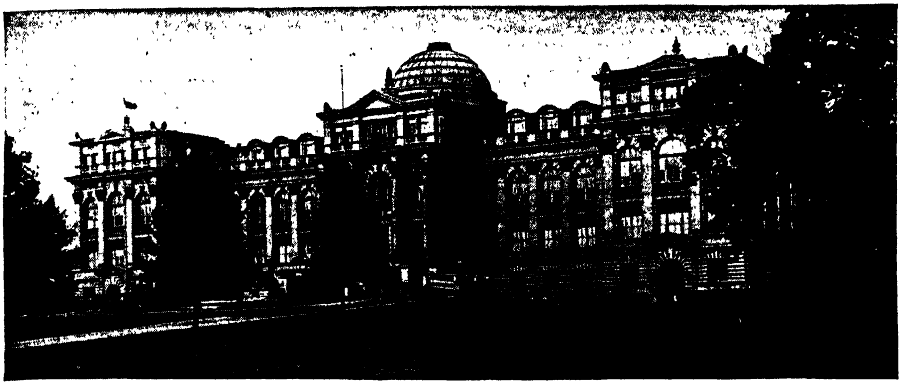
Riverside Park, on the banks of the Hudson below Riverside Drive, is another beautiful park. Above it, on the tree-shaded Drive, are beautiful private houses and tall apartment houses, and beside it is the broad river with its ever changing beauty. Through the lower part of the park runs the Hudson



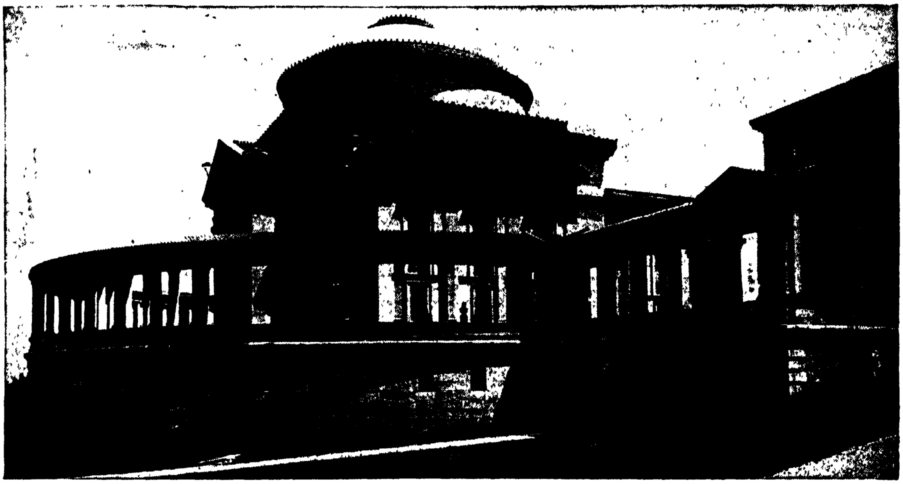
© Ewing Galloway, N. Y.

The New York Public Library now stands on the site of the old reservoir, in the centre of the shopping district. Down the Avenue is the Empire State Building, and behind the library we see a corner of Bryant Park.

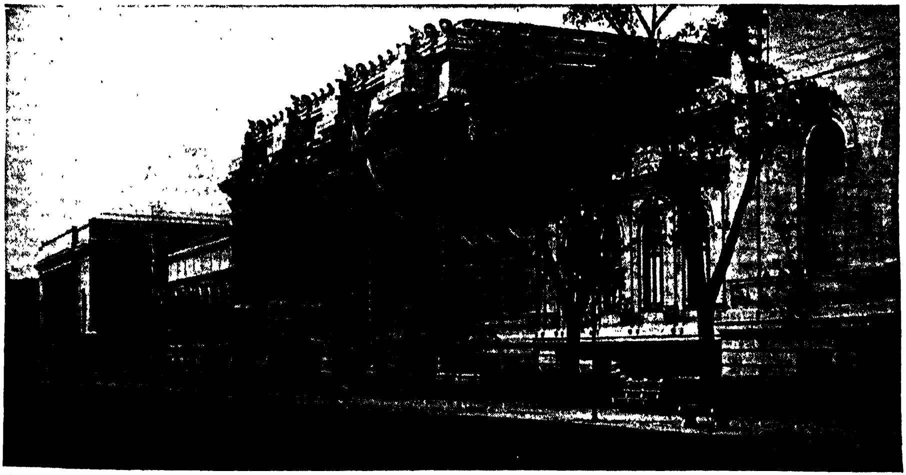
TREASURE HOUSES FOR OLD AND YOUNG



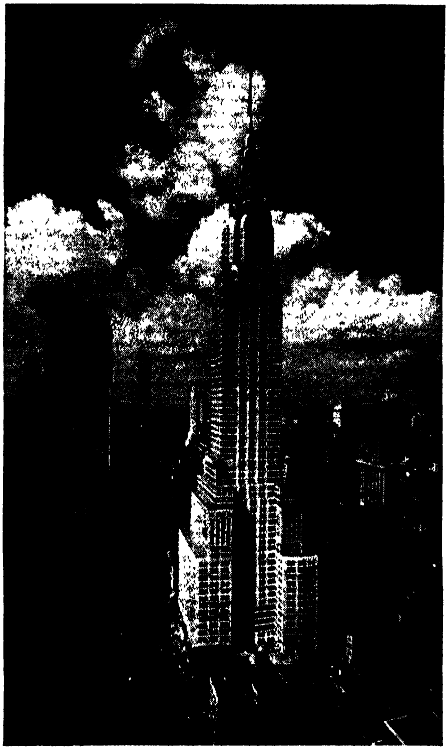
The Museum of the New York Botanical Gardens.



The Hall of Fame and the Library of New York University.



The Metropolitan Museum of Art at Fifth Avenue and Eighty-second Street is one of the great museums of the world. This is only a part of the immense structure which extends up and down the Avenue and deep into Central Park. Thousands visit the museum every day. Photos, Ewing Galloway



© R. I. Nesmith and Associates

The 77-story Chrysler Building, 42nd Street and Lexington Avenue, is the second-tallest building in the world. Its chromium spire flashes in the sun.

River Parkway, part of a continuous express highway that is being built all around the rim of Manhattan Island.

On a rocky promontory at 89th Street and the Drive is the graceful white marble Soldiers' and Sailors' Monument, rather like a Greek temple in appearance, and farther up, at 120th Street, Riverside Drive forks to enclose an oval-shaped green hill crowned with the colonnaded granite tomb where General Grant and his wife are buried. Each year thousands of visitors come to see this tomb. Beyond it the Drive crosses the Harlem Valley on a viaduct, and follows the sweeping curve of the river; past the soaring span of the George Washington Bridge, to the northernmost point of Manhattan.

New York has more than a hundred parks, ranging in size from Pelham Bay Park (1,997 acres) to little breathing spaces less than 200 feet square tucked in among the crowded streets. The larger parks are on the mainland, beyond the Harlem River, or else on Long Island, like Flushing Meadow Park, built on the site of the World's Fair of 1939-40. Van Cortlandt Park, in the Bronx, is well worth a visit. In it you will see a fine old stone house which was built in the middle of the eighteenth century, with beautiful furnishings of the period, and also a lovely sunken garden. Another park which is much loved by the children is Bronx Park, for here are the Botanical Gardens and a wonderful zoo.

Here is almost every animal that you have ever heard of, nearly a thousand different species, including lions and tigers, elephants and hyenas, giraffes and zebras, deer and bears and rhinoceroses. There are also aviaries filled with rare and wonderful birds, and a snake house where you can watch the beautiful sinuous snakes through thick walls of glass. The Botanical Gardens have acres of glorious flowers and shrubs, and large glass conservatories for tropical plants.

THE GREEN AT THE TIP OF MANHATTAN

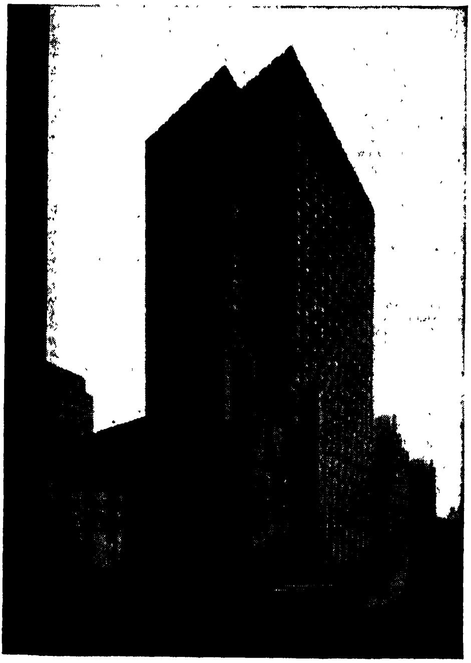
From Battery Park, at the very end of Manhattan, one may watch great ocean-going liners and freighters glide in and out of the harbor. Gulls dip and soar overhead, and there is the chuff-chuff of tugboats. The vast park system of the city contains many playgrounds, swimming pools and other recreation features.

Of the many monuments in New York, few are as beautiful as Washington Arch, which stands at the entrance to Washington Square, looking up Fifth Avenue. On the north side of the arch there are two statues, one of George Washington as commander-in-chief of the army, and the other of Washington as president of the United States.

Although few memorials of the older life of New York have been left, some still remain. Two of the most interesting are the old blockhouse forts, one in Central Park, overlooking 110th Street, the other on the height of Morningside Park. The Jumel mansion, which overlooks the Harlem River beyond the great viaduct which crosses the valley at 155th Street, was Washington's headquarters after his retreat from New York, and afterward the headquarters of the British army. The house is now a museum for relics of the Revolution and for colonial furniture. On Convent Avenue, near the College of the City of New York, you will find a frame house which was once Alexander Hamilton's country place. Most interesting of all the relics of the old times is Fraunces' Tavern, down near Battery Park, on the corner of Broad and Beaver streets, where Washington made his farewell speech to his officers, when, at the close of the Revolutionary War, he resigned the command of the army he had led to victory.

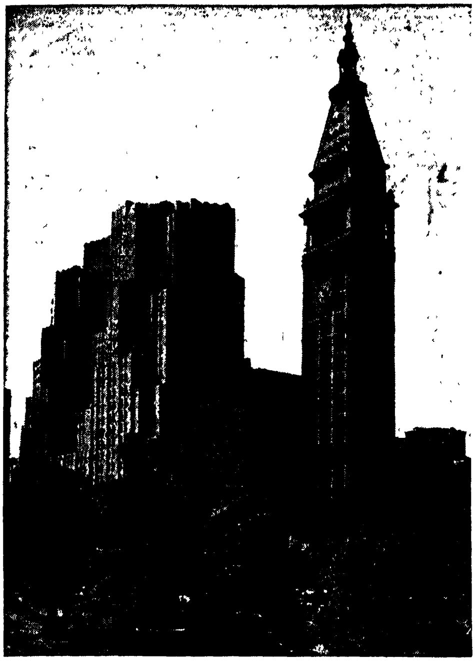
St. Paul's Chapel, one of the eight chapels in the parish of Trinity Church, is the only church in the city that stands as it did before the Revolution. It is on Broadway near City Hall, and it was here that Washington attended church when he lived in New York. It was here that the president and the members of Congress came in solemn procession after the first inauguration. Washington's pew and that of Governor Clinton are there. General Montgomery was buried in the churchyard just beneath the west window, and his monument is separated from Broadway only by an iron railing and a narrow space. The churchyard with its green lawns and quaint tombstones is a quiet place, and many people go there to sit in the sunshine and rest.

Trinity Church itself, on Broadway at the head of Wall Street, is built in the English Perpendicular Gothic style, and it has both grace and dignity. Many famous people are buried in its beautiful little churchyard, including Alexander Hamilton, Robert Fulton, Albert Gallatin and the brave Captain Lawrence of the Chesapeake.



Courtesy, Rockefeller Center, Inc.

The Sixth Avenue side of Rockefeller Center, showing the Center Theatre and the U.S. Rubber Building. The old four-story building makes a strange contrast.



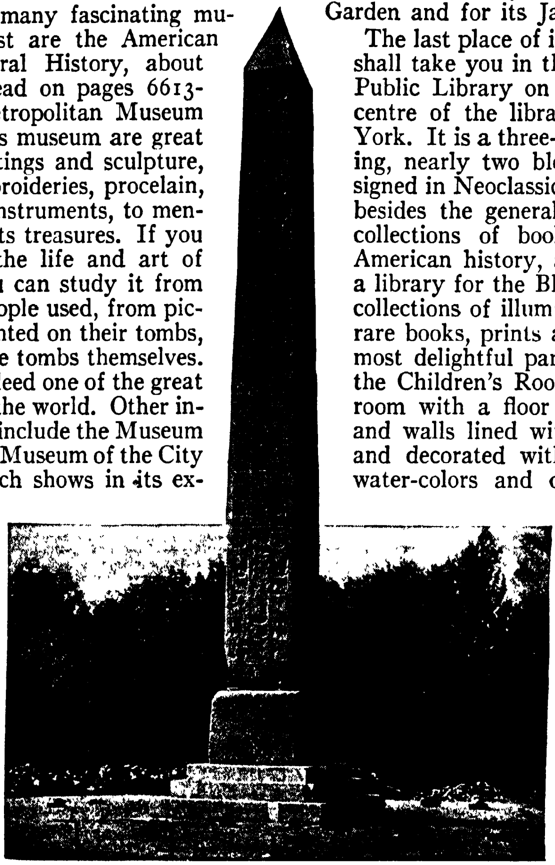
The Metropolitan Life buildings rise above Madison Square. In the clock tower the quarter hours are marked by chimes, and at night by flashing lights.

New York has many beautiful churches, but we can only name a few. The spires of the great Roman Catholic Cathedral, St. Patrick's rise in serene beauty above Fifth Avenue across from the entrance to Rockefeller Center. It is built of gray granite in a Gothic style like that of the Cathedral of Cologne, and the interior is of white marble. The doors are always open, and there is a continuous stream of people going in to pray or to attend services.

Temple Emanu-El, said to be the largest synagogue built in modern times, stands on upper Fifth Avenue facing the Park. It is built of white limestone in the style of the early Romanesque architecture of the East. The interior is richly decorated and it has a beautiful rose window.

The Cathedral Church of St. John the Divine (Episcopalian) stands on a magnificent cliff-like site on Morningside Heights, near Columbia University. It has been in process of construction for more than half a century, and many more years may pass before it is finally completed. It is a vast structure, but the loveliest part of it is the group of chapels, called the Seven Chapels of Tongues, which surround the choir in the apse. In each of these chapels services are conducted in a different language. The Riverside Church, sometimes called the "skyscraper church" because the interior of its tall Gothic tower resembles an office building, stands on Riverside Drive near Grant's Tomb. The Cathedral at Chartres, pictured on page 6157, was the inspiration for many of its architectural features. Its tower holds a magnificent carillon.

New York has many fascinating museums. The largest are the American Museum of Natural History, about which you may read on pages 6613-6622, and the Metropolitan Museum of Art. Within this museum are great collections of paintings and sculpture, tapestries and embroideries, procelain, rugs and musical instruments, to mention but a few of its treasures. If you are interested in the life and art of ancient Egypt, you can study it from objects that the people used, from pictures that they painted on their tombs, or from parts of the tombs themselves. This museum is indeed one of the great treasure houses of the world. Other interesting museums include the Museum of Modern Art, the Museum of the City of New York, which shows in its exhibits the development of New York City life from the earliest days to the present, and the museum of the New York Historical Society, which has priceless collections of manuscripts, books, silver and miniatures having to do with the history of the city.



Thothmes III of Egypt erected this obelisk at Heliopolis, nearly four thousand years ago. It was brought by ship to the United States and set up in Central Park, near the Metropolitan Museum of Art, in 1880-81. Its twin is in London.

Up at the top of Manhattan, overlooking the Hudson, is the Cloisters, a wonderful building of French medieval architecture, that houses a collection of genuine examples of medieval religious architecture, most of it collected by the famous sculptor, George Gray Barnard. This is a part of the Metropolitan Museum of Art. At Broadway and 155th Street there is a group of museums; the Hispanic Museum, the Museum of the American Indian, the Numismatic Museum, which has wonderful collections of rare coins, the Museum of the American Geographical Society and the Museum of the American Academy of Arts and Letters. In Brooklyn there is the Museum of the Brooklyn Institute, and a delightful Children's Museum, the first of its kind to be established in the United States. The Central Museum adjoins the Brooklyn Botanic Garden, which is famous for its lovely Native Wild Flower Garden and for its Japanese Garden.

The last place of interest to which we shall take you in this great city is the Public Library on Fifth Avenue, the centre of the library system in New York. It is a three-story marble building, nearly two blocks in length, designed in Neoclassic style. It contains, besides the general collection, special collections of books on music, art, American history, and other subjects, a library for the Blind, and wonderful collections of illuminated manuscripts, rare books, prints and paintings. The most delightful part of this library is the Children's Room. This is a large room with a floor of warm red tiles and walls lined with low bookshelves and decorated with charming prints, water-colors and oil paintings. The chairs and tables are low and comfortable, and in the windows are cozy seats where it is pleasant to curl up and read. The New York Public Library is one of the largest in the world, and it has many branches in different parts of the city from which books can be borrowed. Brooklyn has a separate library system, and it too has a wonderful children's library.

New York has many schools, and it has a number of excellent special schools, both public and private, that teach special subjects. One interesting school is Cooper Union, an endowed school for the advancement of art and science. It was endowed in 1859 by Peter Cooper as a night school where the arts and sciences might be taught free to young people who have to work during

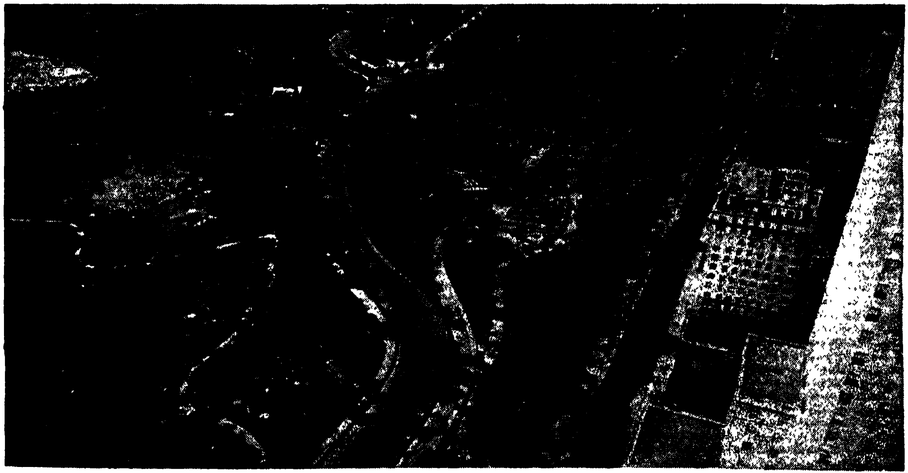
OPEN SPACES FOR REST AND PLAY

© Ewing Galloway

The Japanese Garden in the Brooklyn Botanic Garden.

© Underwood & Underwood

Bathers at Coney Island on a summer day.



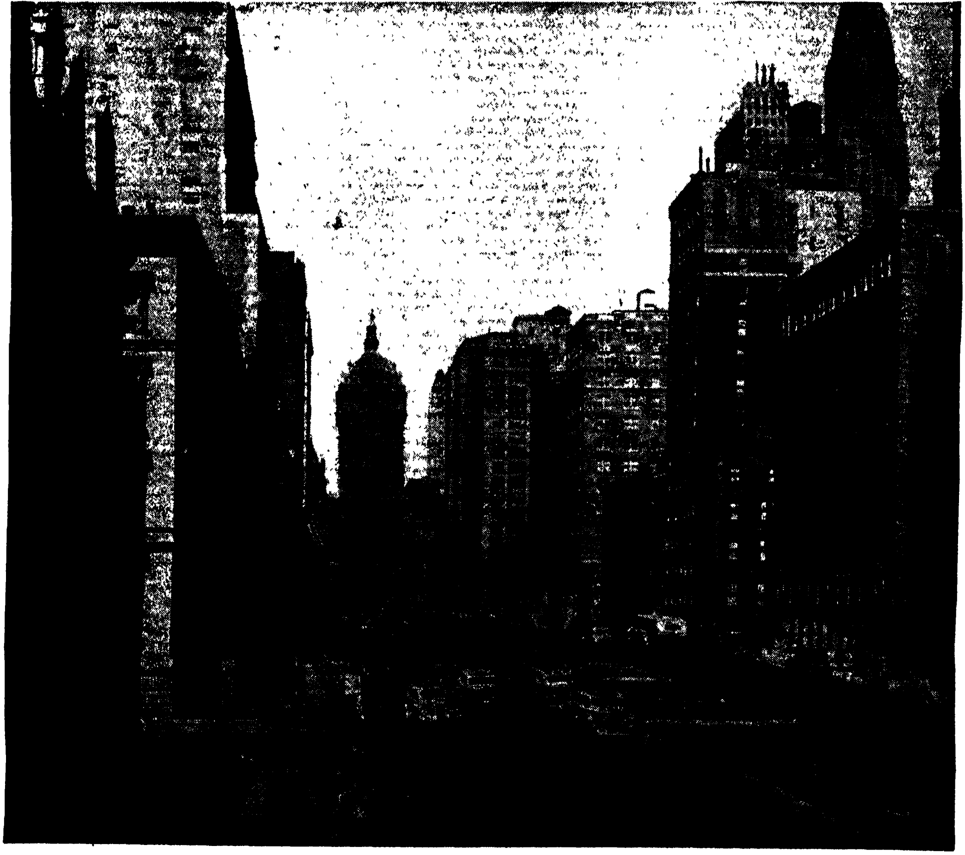
Photo, R. I. Nesmith and Associates

It is hard to believe that this beautiful landscape is in the heart of New York, yet this is an aerial view of Central Park from the southeast corner, with the tall apartment buildings of Fifth Avenue at the right.

OLD AND NEW IN NEW YORK

Left: lower Park Avenue and the famous Park Avenue Hotel in the 1890's. Below: lower Park Avenue to-day. Traffic encircles Grand Central Station on ramps, and comes out on the other side through arches in the New York Central tower.

Top photo, Ewing Galloway; lower, Frederick Lewis.



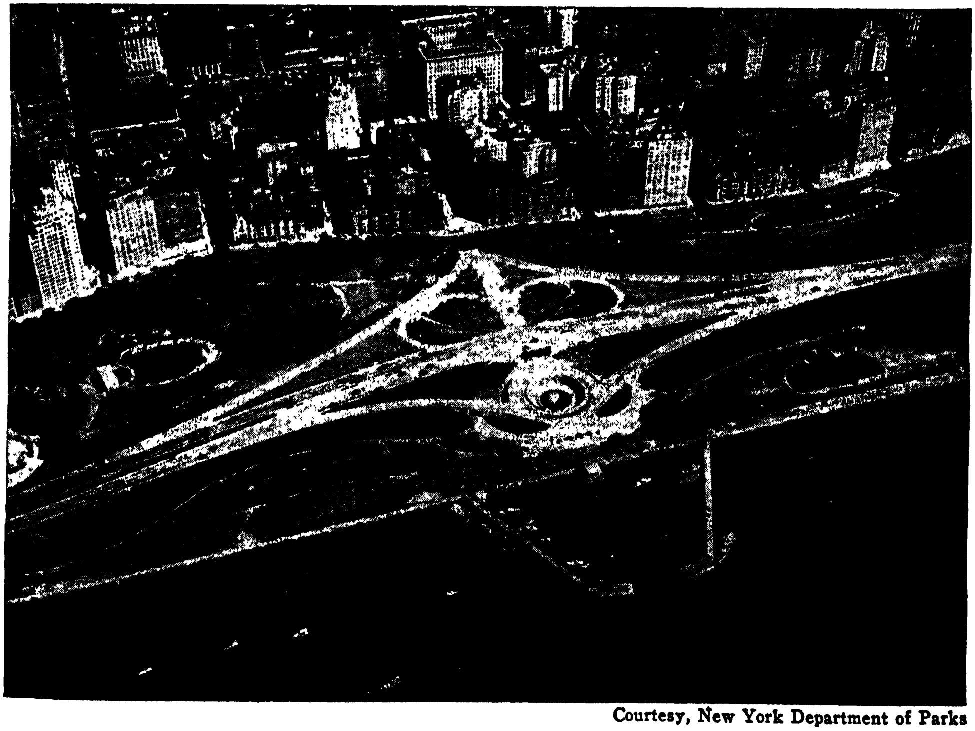
the day. Later on a day school was added. Many thousands of people owe their education in painting and designing, in sculpture, in science or mathematics to this famous school. Outside the building there is a statue of Peter Cooper, the founder, made by Augustus Saint Gaudens, who received his early training at this school. It was at Cooper Union, on February 27th, 1860, that Abraham Lincoln made the famous speech that won him national political recognition.

More than eighteen bridges connect Manhattan with the other boroughs, besides the George Washington Bridge over the Hudson to New Jersey. Of these bridges, the most famous is still the oldest, Brooklyn Bridge, which was opened to traffic in 1883. Besides the bridges, tunnels carry electric trains and motor vehicles under the Hudson and under the East River. Many miles of railways are needed to take people from place to place within the city, and the various subway lines run unceasingly, day and night, to carry passengers bound on a million different errands to their destinations. In Manhattan and parts of Brooklyn and Queens the subways really run underground, but in the more outlying sections of the city they come up on top of the ground and run on elevated tracks, so that they are no longer really subways. No subways run to Staten Island; people go back and forth in long, sleek ferry boats that make the five-mile trip between St. George and the lower tip of Manhattan in twenty minutes. Visitors to New York always like to take this ferry ride, for it provides the most wonderful view of the harbor and the piled up towers of Manhattan.

In spite of all the means of traveling, the crowding is very great. The difficulty lies in the shape of Manhattan Island. It is long and very narrow, and the traffic flows up and down. New tunnels and bridges reduce the crowding for a little while, but the city continues to grow and the traffic soon seems to be as bad as ever.

We have told you of a few of the interesting things about New York. To tell them all would require many large books. It is an interesting city, and offers many opportunities to those who wish to work or to play. Amusement and instruction are equally easy to find.

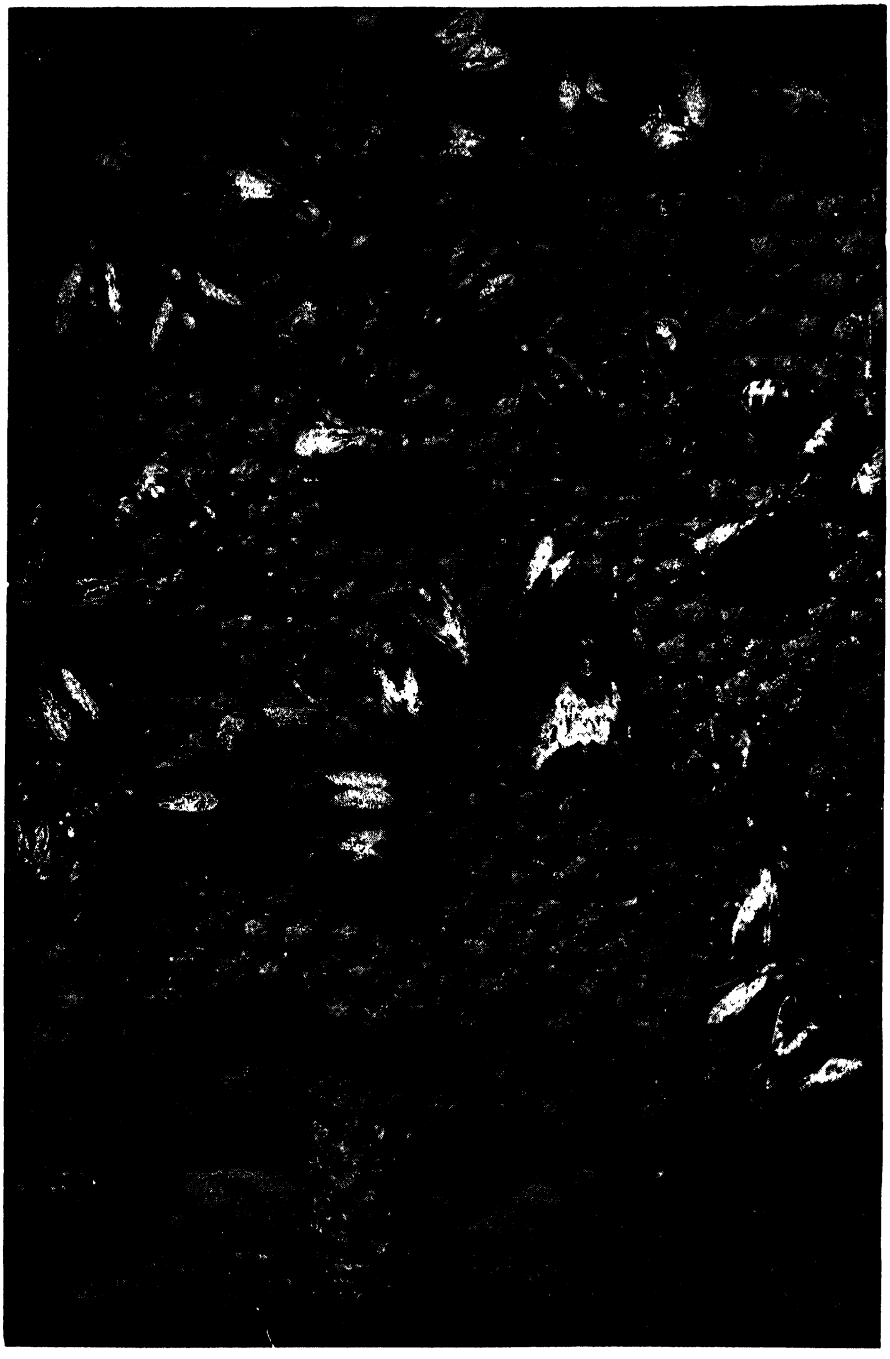
THE NEXT STORY OF THE UNITED STATES IS ON PAGE 6333.



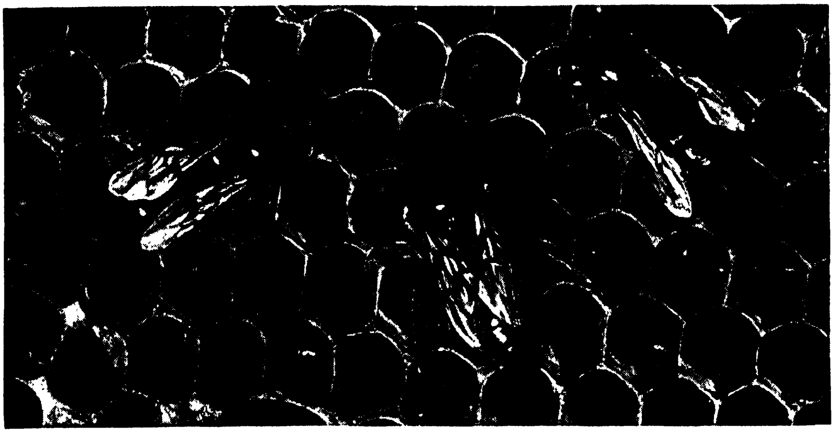
Courtesy, New York Department of Parks

Riverside Drive and Henry Hudson Parkway at the 79th Street circle. There is a wading pool at the left, a playing field at the right, and a small yacht basin in the foreground.

WHAT WE MIGHT SEE IN THE HIVE



This beautiful picture shows us the bees at work on the comb. Some of them are feeding the baby bees in the cells, some of them filling cells with honey, some of them packing in pollen or "bee bread." Down in front there are some empty cells. Perhaps an egg is in the bottom of each. The irregular pouch hanging from the bottom is a queen-cell, in which a baby queen is living, getting ready to lay thousands of eggs. When the new queen is ready to come out and take possession as ruler of the hive, the old queen may lead off a swarm, and start a new hive.



Bees making a comb ready for the queen.

BEES AND WASPS

THE widest literature in the world, next to that of man and his affairs, is the literature of an insect. From the earliest days of learning down to now, poet, philosopher, scientist and common observers have written of the life of the bee. No other creature save man himself has inspired so splendid a tribute.

The reason is twofold. The life of the hive is one of the abiding marvels of nature, an extraordinary civilization much more ancient than our own. Man has observed it because he has dined in the bee's larder since days when he was a wild wanderer on the face of the earth.

Bees were his sole supply of sweetness. Their honey was all he had to make his food and drink sweet. Not until the seventeenth century was old did the product of the sugar-cane reach the poorer people of Britain. Even to the wealthy it was a luxury. For every drink that was sweetened, for every food whose acid sourness was to be made gracious to the palate, the golden honey of the bee was used.

Honey was the forerunner of sugar. It is the standard of sweetness in the Bible, where "sweeter also than honey and the honeycomb" are the judgments of the Lord. Every picture of earthly well-being in days when men walked near God, has honey as one of the principal sources of contentment.

It was a substance in which the Hebrews traded with their neighbors, a delight of the table, a thing to sing songs about.

If we desire further evidence as to the value set on honey we may find it, surprisingly, in a text not of the Bible. It is written upon a tablet of sun-baked clay left by an ancient Babylonian ruler in the long, long ago.

It is an epitaph, written by himself, by an old-time governor, Shamash-resh-usur, and we love him for his claims to the gratitude of posterity. He boasts of no military glory, of no territorial conquest, but believes he is immortalized from the plain fact which he thus sets forth:

> Bees, which collect honey, which no man had seen since the time of my fathers and forefathers, nor brought to the land of Sukhi, I brought down from the mountains of the Khabkha tribe, and I put them in the garden of Gabbari-ibni. They collect honey and wax. The preparation

of honey and wax I understand, and the gardeners understand it.

Shamash declared that posterity would ask with wondering reverence of his name and fame: "Is it true that Shamash-resh-usur, governor of Sukhi, brought honey-bees into the land of Sukhi?"

A WEIRD SUPERSTITION ABOUT THE ORIGIN OF THE BEE

We cannot but fancy that Shamash, the pagan Babylonian, knew more of bees than did Samson, who was the first of men known to history to imagine that true bees issued from the body of a dead animal. Insects much resembling bees do still spring from such carrion, but not actual bees. Drone flies, which closely resemble bees, are thought to have deceived Samson as they deceived Virgil and many more recent writers.

Indeed, the old literature of the bee is full of strange error concerning the life-story of these little insect benefactors of man.

Bees were thought not to be naturally born of parents, like other insects, and, if they did not proceed from the decaying body of a dead animal, to originate spontaneously on flowers. Thence they were carried home as tiny babies by adult bees to the hives. Honey was a sort of dew from heaven, collected, not made by the insects.

We may laugh at such superstitions to-day, though the greatest scholars of olden times and of the Middle Ages believed them. Indeed, it was not until Pasteur proved that life cannot arise without parent-life that this error was reluctantly abandoned by modern thinkers.

THE CHILD OF TO-DAY WHO KNOWS MORE THAN VIRGIL KNEW

For two thousand years boys and girls were taught Virgil's story of the life of the bee, most beautiful in language, shrewdly observant of the truth in parts, strangely full of error in others, enshrining all the old foolish notions which he had gathered from the legends of Egypt, and memorable for this lovely thought, that, as he says, bees are inspired with a portion of the soul of the universe:

> Some have said that bees possess a share of the divine mind, and draw the breath of heaven; for they think that the deity moves through all lands and spaces of the sea and deep of heaven; that hence, flocks, herds, men, every kind of wild beasts, each one at birth, derive the delicate spirit of life; and so in course of things are restored to this fountain, and thither return again by dissolution; and there is no room for death, but each flies up into the place of a star, and climbs the height of heaven.

Bees, to Virgil, had no parents, and all thought the hive to be governed by a king of more than natural powers. To-day a child in school may know more of the facts of bee-life than was known by all the great minds which once considered the problem.

And the charm of it all is that the reality is more wonderful than the myth woven by the imaginative old romancers. Let unadorned Truth tell the story.

Bee-keepers of to-day have improved on the natural home of the bee, by providing hives of timber in which are inserted trays bearing frames of wax ready for the bees to build their cells upon, so husbanding the insects' labors and making their yield of honey more abundant. But we will picture the scene within one of the old skep hives in the garden, for there the bees do all the work themselves.

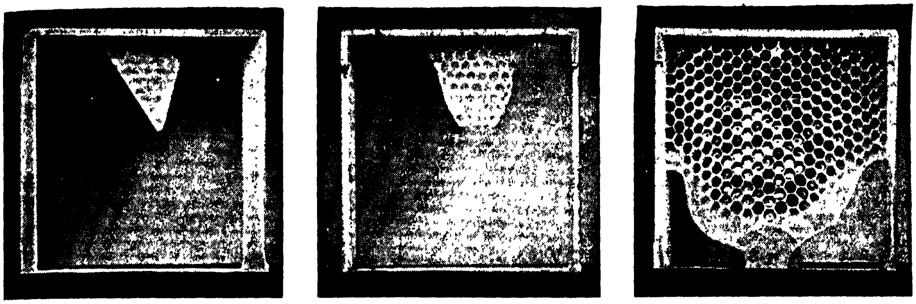
THE MASS OF WORKER BEES WHICH HANGS FROM THE ROOF OF A HIVE

See them placed in, or entering of their own free will, such a skep hive, the queen and her attendant swarm of workers. She is the mother of them all, it may be, and she is urgently impelled by Nature to add to her family. But within the hive all is bare; the interior of a dome of darkness as vast to the bees as the dome of St. Peter's in Rome to a human child.

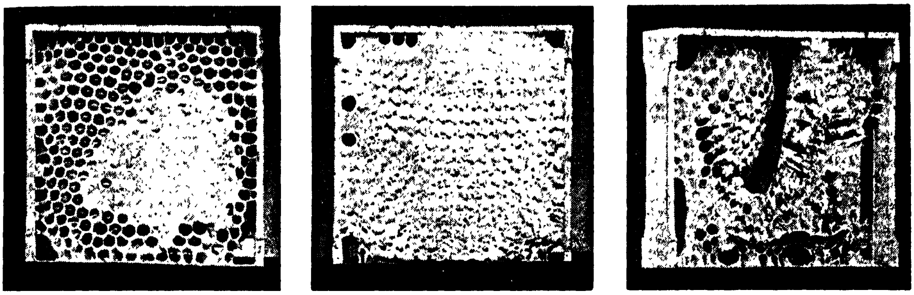
A host of the workers begin at once to clean and garnish the chamber. The remainder hang themselves from the roof of the dome, clinging one to another, so that, as the molecules of a drop of water attached to a solid surface sustain the weight of the whole mass of fluid, so the bees at the top bear the pull of an entire curtain of bees hanging down from the roof almost to the floor.

Thus they hang, hour after hour, practically *thinking wax!* Beneath the edges of the segments of the body of a bee are glands which emit this wax. To do this they must previously have consumed much honey. As the wax slowly makes its appearance it is passed forward to be kneaded and molded by the jaws. The topmost row of bees then press the wax along the roof to form a foundation for the hive. More wax is supplied by the hanging bees below and passed to the builders of the foundation.

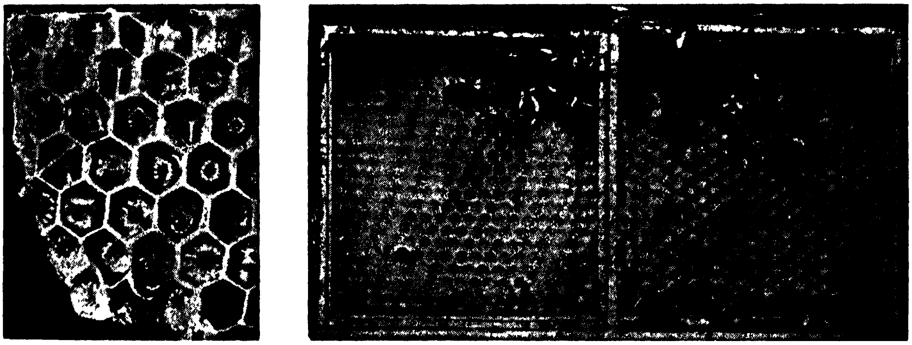
THE WONDERFUL BIRTH OF A BEE



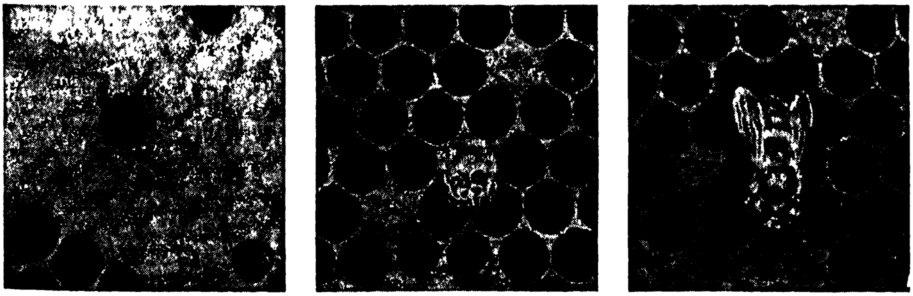
These are three of the frames, called sections, which the bee-keeper puts into the hive for the use of the bees in making the comb. In the first we see the section with the wax foundation ready for the bees. In the second the bees have started building. The third section shows the centre cells filled with honey.



Next we have a frame with all the cells full of honey, and after that the same section with nearly all the cells sealed over with wax. The third is bad work by bees who built their cells without proper wax.



The left-hand picture shows a part of the comb, with the baby bees curled up in their cells floating in the honey, which is to make them big and strong. On the right we are looking down upon two frames and can see the bees actually at work. They are sealing the honey-cells with wax and making all neat.



In these three pictures we watch the birth of a worker bee. In the middle of the first picture there is a half-circle mark, showing where the cell is being opened. Next we see the young bee with its head and half its body free from the cell. In the third picture we see it out of the cell and ready soon to start work.

As soon as this is secured the mass of bees breaks up, and the bees begin to work independently at the building of the comb. Very soon many of the wax cells are ready, each joining others like itself. At first the cells are all of one size and serve as the homes of the young workers and for storing honey and pollen. After a few weeks larger cells are built for the drones and queens.

THE QUEEN BEE WHICH LAYS MORE THAN A THOUSAND EGGS IN A DAY

A young queen at the height of the season (May or June) lays from 1,200 to 1,800 eggs in twenty-four hours. After the second year she lays fewer, but in the course of her four to five years' life she produces many hundred thousand eggs. In the worker-cells and in the queen-cells the queen lays fertilized eggs; but in the drone-cells the eggs are unfertilized. The five or six queen-eggs are not laid simultaneously in the royal cells, but one after another at intervals of one or two days, and the young queens emerge at similar intervals.

Throughout the queen's activities she is waited upon by devoted and respectful attendants who follow her wherever she moves, never turning their backs on her. They feed her, they clean her, they caress her with seeming ecstasy. She is parent, sovereign, all in all to them.

Yet they do not really obey her. They are born to obedience, to observance of a law of which the queen mother is only a living symbol, and only two occasions arise when their will is in conflict with hers.

HOW THE BEES HELP NATURE IN FERTILIZING THE FLOWERS

Then the mastery is with the daughter slaves, not with the royal mother. Let us see what leads to those times.

While the work is proceeding in the hive the workers whose mission it is to go out and forage, fly, day after day, from sunrise to sunset, visiting every flower within range which is not poisonous and which bears nectar and pollen. All in turn are plundered, but only one species at a time. A honeybee collects pollen or nectar on one journey, never both at the same time. There lies a vital value of the bee.

Flowers, to do well, need fertilizing by the pollen of other flowers of their own kind. The bees, clad with many delicate bristles and hair-like processes, become covered with the mealy pollen of the flowers they visit, and, entering flower after flower, leave fragments of that pollen wherever they go. So the fertilization is effected in the exact way that Nature designed.

The pollen, however, is far more abundant than the plants require. Great quantities of it are collected by the bees and stored in little natural panniers, or horny pouches, on their hind legs. The insects bear off such burdens of the pollen for conversion into bee bread that sometimes they cannot reach the hive without resting by the way. As it is received it is placed in cells by other workers, covered with a little honey and sealed up, preserved for future use.

THE WONDERFUL VALVE THAT CONTROLS THE DISPOSAL OF THE NECTAR

The nectar is collected by the bee in two ways. Where the supply is minute the insect can lap up the fluid; but where plenty swells the nectaries of the bloom, the tongue can be fashioned into a pump, and the gracious drops sucked into the first of the bee's two stomachs.

None of the fables tells of a greater wonder than actually exists here. The first stomach is simply a receiver into which the nectar is drawn from the flower. Should she wish, the bee can transfer some or all of it to the second stomach, access to which is given by means of a valve under her control; or the nectar can be returned direct to the mouth to be stored in the cells of the comb.

Thus, when she needs food the bee permits some of the nectar and pollen to pass from the first to the second stomach, where the substances undergo digestive changes as does food when it passes into the stomach of a mammal.

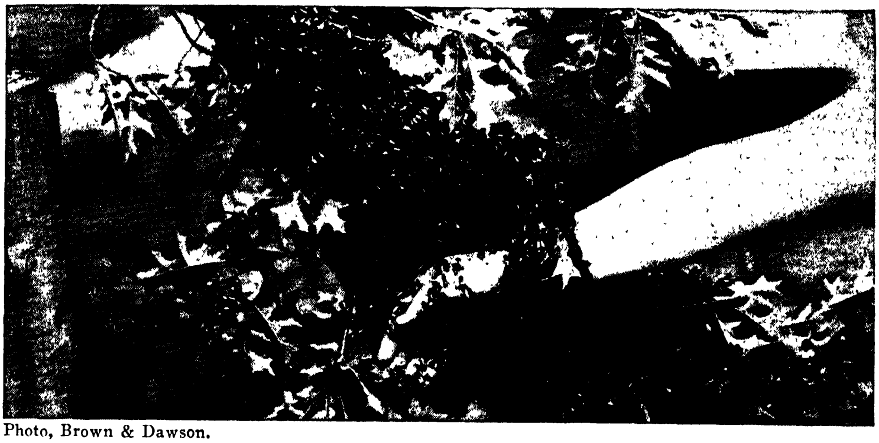
Now, the nursing bees have to feed not only themselves but the larvæ, which are as incapable of assimilating the untreated nectar as human babies are unable to digest the undiluted milk of a cow. The nurses therefore pass the honey and pollen from the first to the second stomach, where, after it has been mixed with digestive juices, it is forced, by way of a special duct, back into the mouth, and is emitted in a thick whitish fluid called bee milk.

Within three days a tiny white maggot has emerged from the egg, and at once demands the attention of several nurses who hasten to fill its cell with bee milk.

The larva not only laps this, but absorbs it through her tender skin. On the fourth day the worker-larva has some honey mixed with her bee milk. After the same period the drones are fed entirely on honey and pollen. But the queen-larvæ, on the other hand, are always fed entirely on bee milk, the royal cells being always flooded with it.

The sole material out of which these vital diets are wrought are the juice and dust of flowers, yet bees juggle accurately with that minute speck of life which comes from the queen mother's egg.

In the hive disciplined wonders are wrought to match these physical marvels. All is as perfectly ordered as in a man-made city, with separate duties for all. There are the queen's attendants, there are the nurses, the servants about the hive who keep the place clean and healthy, carrying out débris like good sanitarians.



Photo, Brown & Dawson.

Before a hive swarms the emigrating bees gorge themselves with honey until they are like the small boy who has eaten too much bread and jam and is too sleepy to play. While they are in this state they seldom sting, and it is quite safe for anyone who does not shrink from them to handle them. Here a girl has thrust her hand fearlessly into the swarm. A swarm can generally be induced to settle in an empty hive by putting it close by, where the scouts can find it, or by putting the queen in it.

THE LITTLE LIVING FANS WHICH KEEP THE HIVE COOL

There are those who tend the weak, and those who collect the bodies of the dead and fly away with them from the hive. Not least astonishing are the ways of those who regulate the temperature of the hive. The busier the bees, the more the heat of their bodies rises, till the hive becomes unhealthily hot. Then the appointed corps of bees whose duty it is, fan for hours with their wings to drive out the heated air and so restore the temperature to its proper level.

The workers have no joy beyond enthusiasm for labor. They have a mother, but no children, no play, no recreation. They begin their toil as soon as they have the strength to stand; they work till their death, which in the summer occurs in about six weeks. Those who last through the winter are of the latest broods of summer.

All the labor, all the refined organization of the hive, is directed to the maintenance of a sufficient supply of live bees in the hive. The queen, after she has taken her wedding flight, returns and never leaves the hive again till she has established an enormous colony of young bees in the cells. As these hatch out they take their turn as nurses in ministering to the wants of larvæ still younger than themselves. At the end of two weeks they are strong enough to leave the hive, and then, but not till then, they go forth to bring in food, and wear and work themselves to death.

HOW THE BEE EATS ITS WAY INTO THE WORLD

Now let us peep again into the cell in which an egg is deposited by the queen. In a few days it hatches and a grub floats in a bath of bee milk. As it grows its head reaches the top of the cell, and there it is fed by the working nurses. Two or three times in the course of its career the larva turns upside down, away from the nurses. Each time it does so it casts its skin, molts like a caterpillar.

Finally, like the caterpillar, it reaches a chrysalis stage, spins itself a silken cocoon, and rests entranced while Nature brings about the great change which transforms it from a grub into a bee. After three weeks the life in the cell is ended: a new bee is about to enter the world.

Its cell is crowned with a mixture of pollen and wax. It must eat its way through. In so doing it feeds itself and gnaws a way to freedom. It comes forth at last, fully clad, but a weak and trembling bee, soft-winged, soft of limbs, incapable of sturdy action for two days. Attendant workers wait upon it, arrange its disheveled-hairs, clean it and offer it honey to eat. Then, as soon as strength has come to it, it hastens to its nursemaid duties, and an older nursemaid is released to fly into the world and rifle flowers while the harvest lasts. It takes about three weeks before a worker bee is strong enough to undertake nectar- or pollen-gathering.

THE ANGRY QUEEN WHO TRIES TO KILL HER DAUGHTERS

Except that they are in larger cells and are differently fed, the development of the males and queens is similar to that of the workers. But the drones are stingless, big and lazy, and have to be assisted to their meals. They do no work. They fly at the appointed time to meet the young queen of other hives. It is their wedding day and their death day, for after their marriage flight they perish.

Once the queen has been mated, the drones are more useless than ever. They are allowed to survive a little while, but in a few days the workers unite to destroy them, either by driving them forth, or by forcing them into an empty comb and starving them to death, or by savagely attacking them with sting and jaws till they are killed.

But now for the royal children, possible queens who may found other families. Quite a different matter is here. The queen, their mother, is an ogress dreadful where they are concerned. She can brook no rival near her throne, not even her own daughters. As they grow up in the cell their voices come to them, and they raise the angry royal pipe. It infuriates their mother, and the fire of battle kindles in her angry heart. She makes toward their cells intending to thrust in her barb and kill them. For the first time her slaves resist her. They will not let her play the murderess—yet. Wiser than she, they gently but determinedly hustle her away from the royal cells. Now either she must go forth, leading a swarm with her, and leave the hive to a new queen from the cells, or tragedy must follow. If the season be young, the queen goes, and thousands of workers go with her.

NATURE'S MERCIFUL PROVISION FOR THE FUTURE OF THE RACE

Like the Israelites on quitting Egypt, they load themselves with treasure, though this time it is their own and consists only of food. So filled are they with honey that they are almost powerless to sting. Taking advantage of this fact, when we wish to take the honey, we blow smoke on the bees. This alarms them and makes them think of danger and journeys: they load up with honey and become almost harmless to us.

While the queen is waiting to swarm, and the royal children are endeavoring to fight their way out of the cells, the prudent workers pile more and more wax on top of the cells to keep the young aristocrats in. Finally they are permitted to come out, when the queen is gone. If more than one should emerge at the same time, two of them fight.

They know exactly where to plant their stings in order to administer a fatal thrust; but so powerful is the instinct for the preservation of the race, even at the cost of the individual, that if two queens in a death-grapple are both so placed that each can kill the other, they draw apart and manœuvre afresh, so that the fatal wound shall be inflicted by one only, permitting the other to survive and carry on the work of repeopling the hive.

But not every queen can swarm in turn. The time comes when it is inexpedient for more bees to go forth to colonize. Then the workers allow the reigning mother to have her way. She goes from cell to cell, and, with a stab into each, slays all her royal daughters.

For from three to four years she may rule her children. Then her strength weakens, her flow of eggs begins to fail. In that case the workers either allow a younger queen to come out and put her to death, or they themselves turn in multitudes on her and quietly end her life so that perfect efficiency in reproduction may again reign in the home. For queen, as for humble worker, the rule of life is the continuance of the hive.

A BEE'S CRADLE MADE OF ROSE LEAVES

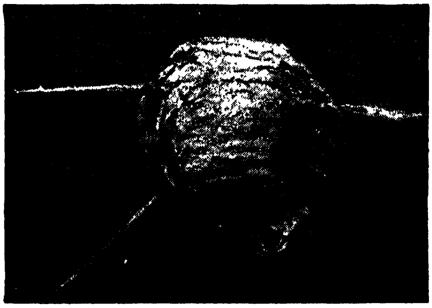
This may be the very first visit of this leaf-cutting bee to a snapdragon flower, but instinct teaches her how to force her way in to extract the honey.

On the other pages we see how swarms of bees work together, but this leaf-cutting bee works alone. Here she is cutting rose leaves for her nest.

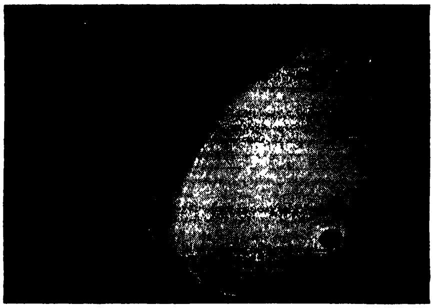
The bee stores each leaf in a tunnel which she has bored in the decayed wood of a tree. She fills each rolled-up leaf with honey and then lays an egg in it. This is a picture of wood cut open to show two such tunnels. When the egg hatches, the grub will eat the honey in its cell.

This is a nearer view of one of the rolled-up leaf-cells which we have seen above; it is full of honey.

Here we see the leaf-cell cut open. Inside is the little bee grub eating the honey stored by its mother.



A wasp is a very nasty insect to touch, but it is very clever. British tree wasps build a nest like this. The nest in early summer is like a small plum, but soon it grows to be the size of a football.



Here is a wonderful wasps' nest, cut from an orange tree in Brazil. Made of a substance like stout cardboard, it is really wood-pulp collected and worked up by the wasps. The little black hole is the entrance.

WHY THE BEES ARE AMONG MAN'S MOST VALUABLE ALLIES

In all else the workers are the adoring slaves of the queen; but, as we see, it is a principle that they worship, and she is the living symbol of that principle. So long as she is capable of producing eggs, day and night, throughout the summer, the rest wait on her like human slaves. When she fails, they turn on her and destroy her, or permit her destruction, as we fell a worn-out tree.

In any case the hive must be maintained at a high pitch of excellence. It is in order to get supplies to feed not only the broods and workers, but the hibernating family, throughout the winter, that bees work so hard. It is that which gives them such value to man. He takes their surplus honey, and they, in getting it, fertilize his flowers and fruit trees so thoroughly as to add a considerable amount yearly to the national wealth.

Such machine-like success attends the operations of the average hive that we might despair of human civilization as hopelessly in the rear of this insect economy.

THE TERRIBLE DISEASE WHICH KILLS THE BEES BY SUFFOCATION

But bees have failings just as we have. They blunderingly admit parasites fatal to their lives and fortunes—such little horrors as the larvæ of the oil beetle, which destroy the bee grub in its cell; death's-head moths, which steal the honey; and other troublesome invaders. Moreover, their discipline sometimes breaks down, with appalling results.

One of their deadliest foes is a mite which invades the breathing-tubes of the bees and sets up what is known as the Isle of Wight disease. The bees are killed by suffocation. Nearly all the old English stock was exterminated in recent years by this malady. How came the contagion so widespread? Because from time to time bees forsake the paths of righteousness, and, instead of foraging on their own honest account, turn robbers and pillage the stores contained in weakly defended hives. In such hives lurked the disease, and the conquerors carried back the seeds of death with their spoils.

THE GREAT COMPANY OF INSECTS WITH 40,000 KNOWN SPECIES

Nothing is perfect, even in the system of the honeybee, which is almost the highest yet, beneath that of man himself. Still, with these little flaws, it remains a scheme of wonder far excelling in ascertained fact, the misty miracles ascribed by all the old writers to these splendid little people.

But honeybees are, of course, only one of innumerable sorts of bees. They belong, as a matter of fact, to a company of insects called the *Hymenoptera,* of which we know probably 40,000 species, while there are perhaps four times as many still to be discovered.

The wild bees are as interesting in their way as the citizens of the hives in theirs; but most of them are not social, and do not assemble in great colonies. Notable examples are the Andrena and Halictus, which tunnel little cells for their eggs in sandy soil, though the adults sleep on leaves, not resting, like fly or bird, on their legs, but holding on by their jaws. The Mason Bee molds grains of sand and saliva into a series of perfect cells, and sometimes not only takes possession of holes in gates, posts and doorways, but even blocks up keyholes with these ingenious nurseries.

THE UNDERGROUND NEST OF THE FAMILIAR BUMBLEBEE

The Leaf-cutter Bee is that artist which takes bites out of our foliage, leaving those crescent-shaped gaps which we see in laurel, rose and other leaves. With the stolen parts it forms neat nests, rolling up the pieces of leaf, placing them in hollows or in special burrows, and charging each cell with egg, pollen and honey.

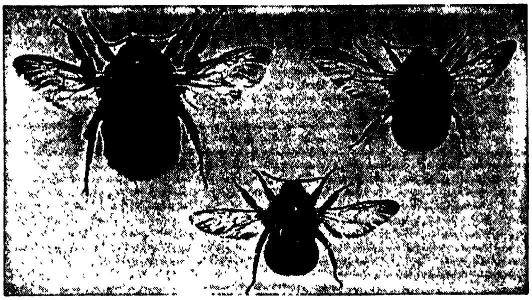
Still more industrious is the Carpenter Bee, which excavates chambers in the stems of plants or in trees, and makes its cradles in a series of these linked nurseries.

Most familiar of all the solitary kinds are the Bumblebees, which dwell in cool and temperate climates. Some make their nests below ground, where one has obtained from a single home combs full of larvæ filling a stable-bucket. Others have their homes above ground, among coarse, close grass and other herbage.

Fierce warriors as they may prove if disturbed, the bumblebees are good friends to us, for they are enormously industrious, perhaps the hardest workers of the entire Bee Family, and their value as fertilizers of clover alone is beyond all calculation. Their short stout bodies and dense hairy covering adapt them for life in cold regions.

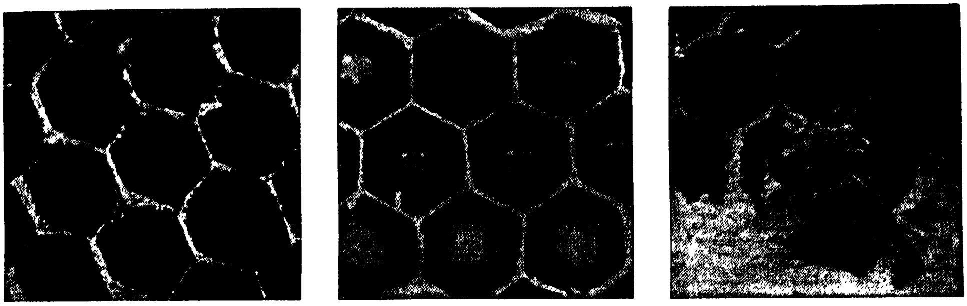
BEES, WASPS AND SAWFLIES

Leaf-cutter bee.

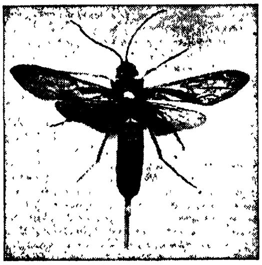


The queen, worker and drone of a bumblebee.

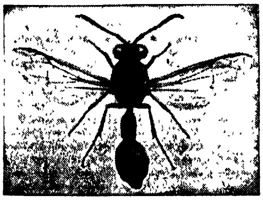
The palisade sawfly.



Three stages in the life of a wasp. The left-hand picture shows eggs in the cells. In the centre, the larvæ, or grubs, have hatched out. A grub after some days spins a cocoon, and inside it, still in the cell, changes into a wasp. At the right a wasp is breaking out of its cell.

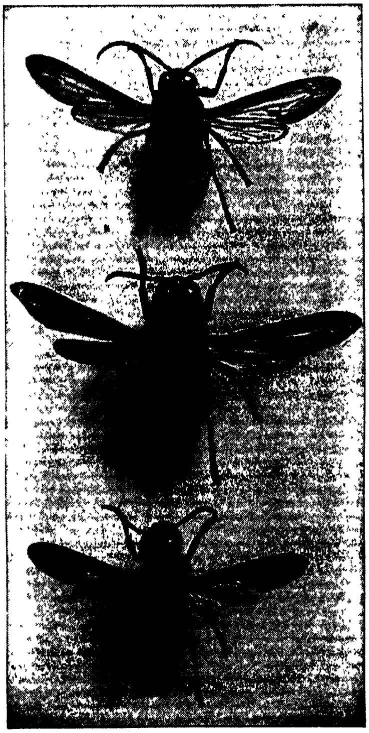


Giant tailed wasp, or sirex.



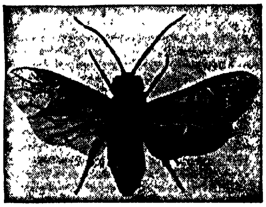
A solitary wasp.

A wasp drone.

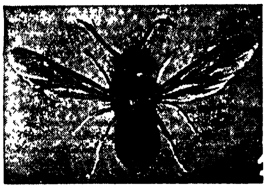


The drone, queen and worker hornet.

Orange-colored sawfly.



Gooseberry sawfly.



A wasp worker.

THE WASP FAMILY INCLUDES SOLITARY AND SOCIAL SPECIES

Now we must turn to another vast company, the Wasps, which, many in species and habit, may be grouped into two divisions, the solitary and the social kind. They make no honey, they perform no direct service for man; but they are indirectly valuable servants, inasmuch as they kill tremendous numbers of flies and other insects hurtful to us.

Let us at the outset get this matter into figures. It has been found that the inmate workers of a small wasps' nest brought home daily no fewer than two thousand flies, a number which might safely be multiplied by ten or twelve as the season advanced and more lives appeared.

Against this fact we have to remember that wasps do some injury to growing fruit, that they sting us very badly, that they sometimes run amuck for unexplained reasons among horses and cattle, and drive them to madness and death with their stinging barbs.

In practice there is little to choose between the sting of bee and wasp. Both, inflicted on the tongue, may be fatal; both are highly painful and alarming.

In a way, the home of the Social Wasp challenges a respect and admiration second only to that of the bee. We get nothing out of it but stings or a combful of grubs which fishermen use as bait. But the wonder is there none the less.

It lacks the continuity of life proper to the hive, for there is no winter existence. As autumn approaches, the nest disappears. The workers and the drones die. Only the young queens, previously fertilized by the drones, remain. They retire under a roof-edge or in some corner of a shed, seize with their jaws a fragment of straw or rags, and hanging on, wrap their wings around them, and enter on their winter sleep.

In the early spring the queen makes a little hole in some secluded bank; she may even go back to a nest previously used. There she begins a comb, not of wax, but of a sort of paper fashioned from woody fibres which she chews with her jaws into this substance. Here in the cells she lays her eggs, and hunts industriously to bring in food for the grubs as they hatch. When the neuter workers appear they relieve her of her nursing and foraging duties.

THE PAPER NESTS HANGING IN THE BRANCHES OF THE TREES

They bring in food and tend the oncoming generations, and thousands on thousands of wasps appear in a single nest in the course of a hot summer. First come the sexless workers, then the males. They, like the drones of the hive, do no work, but fly forth to meet queens from other nests. The summer and autumn wane, and the combs, now tier below tier, are crowded with grubs not yet mature. But the time has come for all but the mother to die. The last act of the active workers is to kill all that remain unhatched.

The land is left once more to the queens. They alone survive to await the sleep of winter and the advent of a fresh spring.

The Hornet is the largest of our social wasps, an insect one inch in length and armed with a desperate sting. It nests in hollow trees or beneath the eaves of barns, and its brood rarely consists of more than two hundred offspring in the most favorable seasons. Then there is a notable Wall Wasp with us which calmly digs away the mortar of our walls, forms a tube-shaped tunnel and places its egg in it. Other wasps construct great paper nests attached to the branches of trees; some make their homes of mud, of clay, of sand mixed with saliva, and so forth.

The Sphex Wasps catch grasshoppers and crickets, paralyze them, and store them, four to a chamber, in place of honey and pollen for their larvæ.

THE TINY GRUB AND ITS BIG STORE OF FOOD

Practically all the wasps leave paralyzed prey for the sustenance of their progeny, but the habit is not entirely to our advantage, for one member of the species captures honeybees and serves them in the same way, five precious bees sacrificed to appease the appetite of each wasp grub.

Wasps undoubtedly possess intelligence, in some respects excelling that of the well-disciplined bee. A bee inclosed in an uncorked bottle whose base is extended toward the light, will beat its head raw trying to fly out of the bottom of the bottle; but the wasp will find its way to freedom through the open neck.

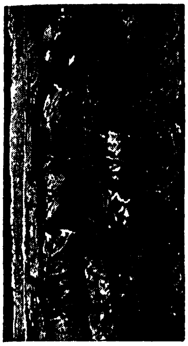
Watchers have noted with delight the extreme pains the wasp takes to learn the

WONDERFUL HOMES OF BEES AND WASPS

The nest of the tree wasp.

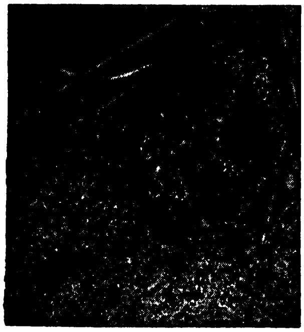
The little gall wasp.

Nest built by a wasp queen.


Home of leaf-cutter bees.

Cells in nest of the common wasp.

Mud-wasp cells on a brick wall.

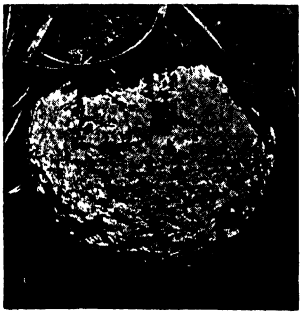

The Sphex wasp and burrow.

A large swarm of bees.

Entrance to bumblebee's nest.

A tree wasps' nest.

Cocoons in a bumblebee's nest.


A hanging wasps' nest.

site of the place in which it has constructed its nest. It does not fly a mile away and then straight back as the outcome of pure instinct. Before departing it flits from point to point, noting landmarks—here a leaf, there a stone and a blade of grass, farther away a whole bush or plant, till everything in the neighborhood has been built up into a memory map. When it comes back from a long hunt bearing a victim, it will drop its prey while it searches out its landmarks. No human airman is more careful in his observations of guide-posts than a wasp.

In addition to these greater wasps which we have been studying, there are innumerable related forms which include one of the most important of groups, the thousands of species of Ichneumon Wasps, called generally Ichneumon Flies. They have the long apparatus at the tail which in the wasps and bees is a sting, but here is only a hollow drill serving to penetrate the body of a victim and thrust down an egg into the wound.

THE LITTLE WASP WHICH BURIES ITS EGG IN A CATERPILLAR

To these we owe unstinted gratitude, for the majority of them make caterpillars their living cradles. The idea is horrible, of course, but if it were not practiced by these insects, caterpillars might devour the bulk of our vegetable crops. It is the mission of entomologists to learn more about these useful parasites and encourage their multiplication.

Related to these are those master detectives, the parasitic Gall Wasps, some of which pierce the tough nest of the mason bee, and place an egg in the body of a hidden larva, while others, as the Gouty-legged Wasp, do the same to the larva of beetles living in water. Even more marvelous are the feats of the Egg Wasps, which actually lay their eggs in the eggs of moths and butterflies, and so prevent these from hatching into caterpillars.

Another fascinating company are the true gall wasps, or *Cynipidæ*. Not all the galls observed are produced by these minute wasps, but those on the oaks and the roses are. How the galls arise around the egg and developing larvæ is still something of a mystery. It is fairly clear, however, that the gall does no harm to the tree. As a matter of fact, we benefit, for the finest of the old inks was obtained from the gall nuts of the oak.

WHY THE STEM SAWFLY IS AN ENEMY OF MAN

Closely related to these groups are the Sawflies, an important assemblage of insects of which foresters and tree-lovers in general go in dread. Some infect the stems, some the leaves, and some the solid wood of trees and plants to the infinite hurt of the living growth.

The eggs of sawflies are deposited by the parent in the stalks of rye and other grain, and the shoots of our pear and other trees. They live in the grub stage entirely on the substance of the host, and work terrible damage where their numbers are large. Hidden from human eyes, they eat the immature substance of a growth which should become food.

Then there are the great tailed wasps, the giant Sirex, and others, members of the *Siricidæ,* which lay their eggs on pine trees, where their destructive larvæ undergo so long a period of hungry infancy that often they do not complete their cycle of infant life till the tree has been felled, sawed up and built into the fabric or furniture of a house. Then out comes a booming Sirex, probably as startled at its unnatural surroundings as the lawful inmates of the abode at its unexpected and unwelcome appearance.

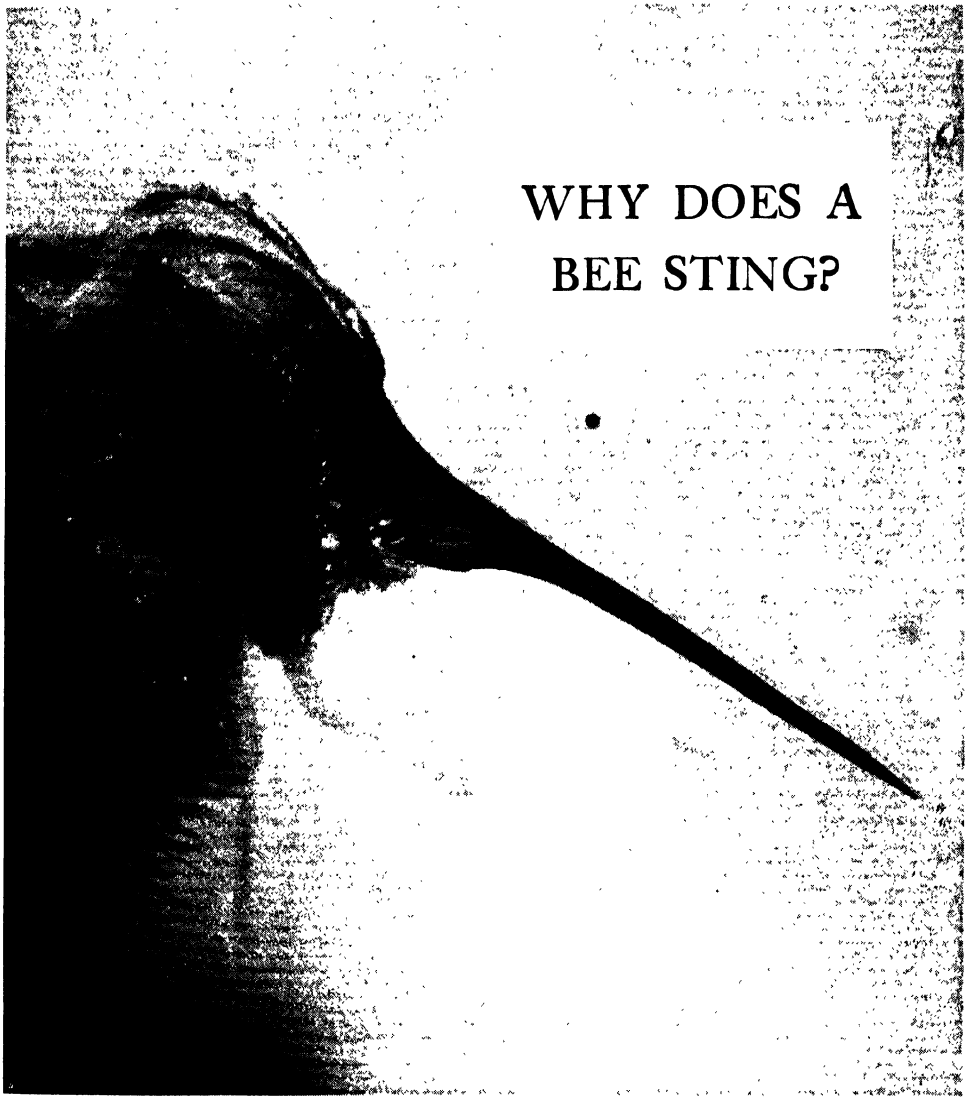
With the true sawflies we are all more familiar, for they are among the worst pests we have in our beautiful pine woods. The eggs are laid on the leaves or needles of the trees in such numbers that when the larvæ appear the tree seems alive with them; it is colored by their swarming numbers, and its branches are bowed down with the weight of the crawling army of devourers.

HOW NATURE HELPS MAN BY KEEPING DOWN AN ENEMY

Any child in a garden has seen what havoc little plant-lice can work with roses, killing old growth and preventing new, so we can all imagine the effect on pine trees of teeming swarms of lusty grubs of the sawfly. They are indeed one of the greatest menaces to our timber. Here again we are aided by Nature, for it is known that no fewer than forty species of winged parasites infest the sawfly larvæ; while even the wicked little mice do us a good turn when winds and rains cast down the grubs, or when the larvæ have turned into chrysalises and fallen to the ground.

THE NEXT STORY OF ANIMAL LIFE IS ON PAGE 6349.

WHY DOES A BEE STING?

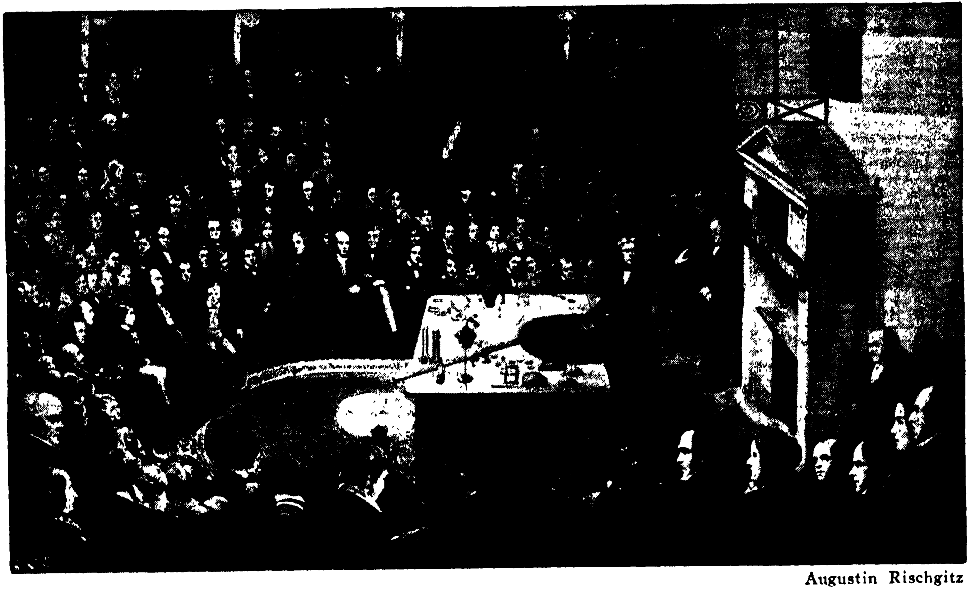


Roman Vishniac

Enlarged, the stinger of a bee looks menacing indeed. This is the stinger of a queen bee, without a barb.

A BEE stings to protect itself or the hive from danger. It is the worker bee which has this duty of protecting the community. The stinger, a long, hollow tube with a barb at the tip, grows out from the rear end of the insect's body. When the bee needs to protect itself, a drop of poison is forced down the tube, the barb is driven into the foe and the poison is discharged. A bee can sting only once, as a general rule, for when the insect tries to withdraw the stinger, the barb usually breaks off. Sometimes the stinger is so roughly torn from the bee's body that it dies. The queen bee's stinger does not have a barb, and so she can use it again and again to sting rival queens. The drone has no stinger. There are several stingless bees. Some have a sharp bite; others, instead, drop a poison on their enemies.

THE NEXT WONDER QUESTIONS ARE ON PAGE 6424.



Augustin Rischgitz

Faraday, lecturing before the Royal Institute, London. His research led to the invention of the dynamo.

The MAKERS *of* TELEGRAPHS TELEPHONES *and* RADIO

THIS is the story of men who have made it possible for us to talk and to send messages and pictures over long distances by means of electricity. As you know, we can do these things by using wires or streams of electrons. You will find detailed accounts of the telegraph, telephone, radio, television, electronics, etc., in separate chapters of your BOOK OF KNOWLEDGE. Here we shall speak of some of their inventors.

The ways of long-distance communication have come to us through the work of thousands of men over more than two hundred years. Most of these men are unknown to us because their work has largely been to improve and perfect details necessary for the success of the whole. The remarkable thing about the discoveries and inventions in all fields of electricity is that they have been made by trained scientists, or by men of scientific turn of mind. Invention in electricity is quite different from ordinary mechanical invention. For example, the invention of the cotton-gin, to remove the cotton fiber from the seed, and the invention of the grain-reaping machine were the solving of purely mechanical problems. Electricity, however, is a form of energy that required long years of investigation and experiment before men learned the nature of it, how to generate it, how to control it and make use of it.

The telegraph was the first important practical use to which electricity was put. The great step leading to its invention was the discovery that some substances are good conductors of electricity, and other substances are non-conductors. We have records of experiments carried out as early as 1729 by an Englishman, Stephen Gray, who carried electrical current 886 feet along a conductor supported by silk threads (silk is a non-conductor). Later, another Englishman, Sir William Watson, carried electricity two miles along metal wires, and saw that it seemed to move from one end of the wire to the other instantaneously. Other men transmitted electricity more than eight miles, and then it dawned upon a number of people that here was a means of transmitting signals and perhaps messages any number of miles, far beyond the ordinary human range of sight and sound. Scientists in Europe and America were aroused by such a possibility.

From the earliest times, in all countries, men had tried to communicate with one another over long distances. They knew of only two ways of doing this, by sound-waves that could be heard, and by light-waves that could be seen. The savages of some regions of Africa and South America used great wooden drums upon which they thumped out messages that could be heard for miles. The prairie Indians of North America, by the skillful use of a blanket held over a small smudge fire, would send up smoke puffs in a kind of code which could be seen for many miles. Speaking trumpets have been used from the earliest times to shout messages and commands far beyond the range of the ordinary human voice.

Before the invention of the electric telegraph, governments used various systems of relaying messages by means of a chain of signal towers, placed within sight of one another and usually on hills or high ground. Messages could be flashed by mirrors from one station to another—if the sun was shining. At night the signals could be flashed by lamps—if it was not raining. Semaphore arms that moved up and down, or "wig-wag" flag signals, could be used to spell out messages from one signal tower to the next. After field glasses came into use the messages could be seen from a greater distance. By means of such chains of stations, messages have been flashed hundreds of miles in the course of several hours. Telegraphing means distance-writing; and all these devices may be called telegraphing of a sort. We generally reserve the word for electric telegraphing, or electric telegraphy. The word telegram (for the message itself) did not come into the language until after 1850.

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Hans Oersted, who did pioneer work in electromagnetism.

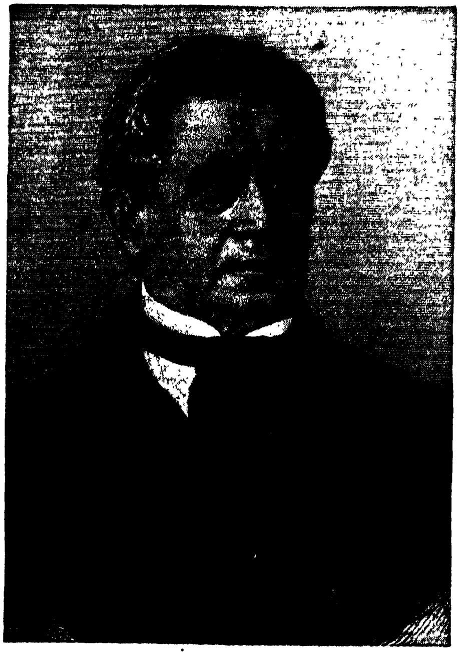
Alessandro Volta, Italian physicist, and inventor of the first crude form of an electric battery.

Long and detailed messages had to be sent by swift riders, working in relays, day and night. Such were the famous royal messengers of the ancient Persians, and the pony-express riders who carried mail across the plains and mountains to California in the middle of the nineteenth century. A hundred years ago long-distance communication was no swifter or more satisfactory than it had been for thousands of years. Transportation was being speeded up by the invention of steamboats and railways, but slow means of communication were holding back progress.

Before 1800 many important discoveries had been made about electricity, and it had been shown that electric signals could be sent over wires. Benjamin Franklin made some experiments using four miles of wire. But no one had yet made successful sending and receiving devices, or a dependable source of current. The first important step along these lines was taken when the Italian physicist, Alessandro Volta (1745-1827), carrying further the experiments of Luigi Galvani (1737-98), invented the voltaic pile in 1800. This was the first crude form of an electric battery. It was very soon improved in many ways by other scientists, and today the electric battery is one of the most important means of generating electric current. Batteries gave the experimenters in telegraphy a dependable and strong source of electricity; and batteries are still widely used in telegraphy, although current generated by dynamos has come into use as the main source of supply in larger systems.

HANS OERSTED, OF COPENHAGEN, GAVE TELEGRAPHY A BIG BOOST

Telegraphy was given a big boost by Hans C. Oersted, a Danish physicist. He was born in 1777 and died in 1851. He studied medicine and, in 1800, became a teacher at the University of Copenhagen. His strong interest in physics led to his appointment in 1806 as professor of physics in the university, and in 1829 he became a director of the new polytechnic school at Copenhagen. His greatest work was the result of experiments with the magnetic needle and an electric current. These showed him the relation between electricity and magnetism, and proved that a current moving through a conductor sets up a magnetic field around it.


Joseph Henry, mathematician and physicist.

Brown Bros., New York
Sir Charles Wheatstone, who made a magnetic telegraph.

One of the greatest scientists of modern times was Michael Faraday (1791-1867). We tell you about his life on page 3984. Sir Humphry Davy, the great English chemist, was favorably impressed by Faraday's ability and took him as an assistant in chemistry. Faraday immediately began to show results in his thorough work, and then became interested in electricity. In 1831 he began publishing the results of his work in electricity. One of the most important discoveries he had worked out was that a magnet could be made to generate an electric current in a conductor which was moved through the magnetic field.

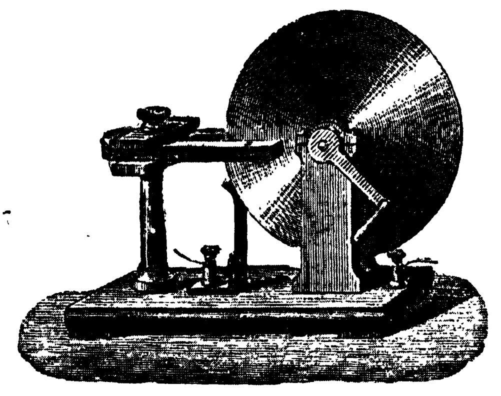
Oersted had shown that a moving electric current would produce magnetism, and Faraday showed that magnetism, in turn, would produce an electric current. This laid the foundation for the invention of the dynamo and the electric motor, and was another step in the development of the telegraph. Faraday's researches extended much further into the fields of electricity, chemistry and physics, making him one of the most noted scientists of the nineteenth century.

One more step in the scientific field of discovery remained to make the telegraph a success, and to make a complete foundation for many other electrical inventions. This was the work done by Joseph Henry. Henry was born in Albany, New York, in 1797, and died at Washington, D. C., in 1878. After graduating from the Albany Academy he began the study of chemistry, anatomy and physiology, intending to become a physician. There were no great scientific and technical schools at that time such as we have today, and many scientists got their first start in the medical schools.

Joseph Henry became interested in engineering, and in 1826 he was elected teacher of mathematics and physics in the Albany Academy. In 1827 he read a very important paper before the Albany Institute on Some Modifications of the Electro-Magnetic Apparatus. He exhibited and demonstrated his discoveries with small electromagnets wound with silk-covered wire. These magnets had lifting power many times greater than any that had been known up to that time. Henry made further discoveries and developments in the field of electromagnetism, and helped to pave the way for Morse and others in the development of the telegraph. In 1846 he became secretary of the Smithsonian Institution in Washington.

It is not possible to say that any one man invented the first electric telegraph. A large number of men had been gradually developing it for nearly a hundred years before the first practical and commercial telegraph was put into operation in 1844. Samuel Finley Breese Morse, an American, is generally given a great deal of the credit for the invention. Yet there were a number of men among whom credit for making the telegraph should properly be shared.

Sir Francis Ronalds, an Englishman, born in 1788, was one of these. He made a telegraph system that would send messages eight miles. The current was furnished by a friction machine, and at each end of the line there was a dial which would show letters of the alphabet. Ronalds offered his telegraph to the British government. The government officials, however, would not hear of an electric telegraph.


Faraday's electric generator. This scientist made the important discovery that magnetism produces an electric current.

Another telegraphy system was invented at about the same time in England by Charles Wheatstone, who was born in 1802 and died in 1875. The early part of Wheatstone's life was almost entirely devoted to making and experimenting with musical instruments, having been apprenticed to his uncle, who was in that business in London. Wheatstone had a good education, but apparently not a scientific one. However, he became interested in experimenting with sound, and his work was so valuable that in 1834 he was appointed professor of experimental philosophy at King's College in London. His experiments led him into the field of electricity, and by means of a device using a revolving mirror he determined the speed of electrical discharges in conductors. This in turn led him to undertake the invention of an electric telegraph. He formed a partnership with William Cooke, who was a good business man, and after many experiments he took out the first patent for a magnetic telegraph in 1837. No practical use was made of this until after Morse had put his telegraph into operation in 1844.

Wheatstone's first telegraph used five lines of wires, and proved impractical for general use. Next he reduced the number of wires to two, but even this was too expensive. In 1845 he brought out a system using one wire, and this was a success. It was known as the five-needle telegraph, and was in general use in England for many years. Wheatstone kept on experimenting and devised many new instruments, his most noted being the automatic telegraph, invented in 1868, by means of which 500 words a minute could be sent. Among the various telegraph receivers he invented was the printing receiver. He also experimented with submarine telegraphy. He died in Paris while working on a receiving instrument for submarine cables. Wheatstone's early training in making musical instruments helped him in devising the delicate electrical instruments required for long distance telegraphy.

THE BEGINNING OF TELEGRAPHY AS WE KNOW IT TODAY

In 1844 Samuel F. B. Morse sent a message on his telegraph between Washington and Baltimore. That was the beginning of telegraphy as a successful commercial thing. The time before that date was what we might call the experimental period. Most of the inventions up to that time had used some form of magnetic needle, pith balls, or the like, which were moved by the magnetic field set up at the receiving end of a conductor. One German inventor made use of the spark at the receiving end to indicate the message. The problem was to have a device that would record the electrical impulses at the receiving end. It was easy enough to make and break the circuit at the sending end to send short and long impulses, which could form a code standing for letters of the alphabet. The trouble was that over a long distance the electric current would grow weaker and weaker, and only the most delicate devices could record the electrical impulses. The faint currents at the end of a long line could not operate a mechanical recording device successfully. Morse's device for long-distance telegraphy established a method, or principle, of remote control that is the basis of long-distance communication and remote control in the telephone, radio, television and other applications of electricity.

THE STRUGGLES AND TRIUMPHS OF SAMUEL F. B. MORSE

Samuel Finley Breese Morse was born in Massachusetts in 1791 and died in 1872. He graduated from Yale in 1810. His ambition was to be an artist. He studied painting and sculpture in England, and received a gold medal in 1813 for his sculpture, The Dying Hercules. He returned to America in 1815, and in 1824 organized what was to become the National Academy of Design. He was its first president.

After another stay in Europe, Morse was made a professor in the University of New York City. There he became interested in electricity and studied it intensively. In 1832, while returning from Europe on the sailing ship Sully, he passed the time away by working out a scheme of telegraphy. He showed his designs to various passengers and to the captain of the ship. It was a lucky thing that he did this, for ten years after his successful demonstration in 1844, a man named Jackson sued him, claiming to have invented this type of telegraph before Morse had. The captain of the ship Sully was among the witnesses who testified for Morse, and Morse was able to prove that his invention had come before Jackson's.

Morse was delayed in building his first device, but it was completed and exhibited in 1835 at the New York University building. In 1837 he made a much better device, and filed an application for a patent. The following year he asked Congress to appropriate money for an experimental telegraph line between Washington and Baltimore. This request met with so much unbelief and ridicule that Congress did nothing. Disheartened, Morse went to England, but he got the same refusal from the English government that Francis Ronalds had received years before. He was even refused a patent. Morse next tried the French, but they would have nothing to do with it either, so he went back to the United States.

"WHAT HATH GOD WROUGHT!", THE FIRST TELEGRAPHIC MESSAGE

For four years Morse went through many privations in his struggle to interest someone in financing his telegraph. Finally, on March 4, 1843, he was told that, in the last hour of the closing of its session, Congress had voted $30,000 for his experiment. In 1844 the work was finished, and on May 24 the first message, "What hath God wrought," was sent from the Supreme Court room in Washington to Baltimore.

From that day the telegraph was a success. It was quickly adopted by most of the European countries, but they paid Morse nothing for it at the time. Later, the sum of 200,000 francs (about $40,000) was presented to him by various European governments. He also received many medals and honors. Another American, Alfred Vail worked with Morse on his telegraph and invented many of the devices that were needed to make the telegraph a success. Vail was born in, or near, Morristown, New Jersey, in 1804, and died in Morristown in 1859. He was graduated from New York University in 1836 and the following year started working with Morse on the telegraph.

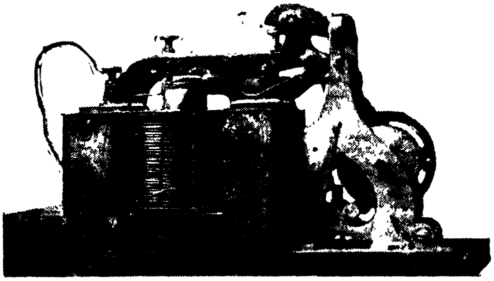
Vail invented the finger key, and the code of dots and dashes for letters of the alphabet. This is known as the "Morse Code," though Vail invented it.

Vail was the man at the receiving end of the line, at Baltimore, Maryland, when

Morse sent his message from Washington, "What hath God wrought!"

One of the most important devices invented by Vail and Morse is the relay. This is an ingenious device at the receiving end of the line by which the feeble incoming currents open and close a circuit from a battery to the receiving instrument. The current generated by the battery is strong enough to work the sounder, or Morse register. That is, the faint electric impulses coming in over the wire do not directly work the receiving instrument, but, by using in the relay one of the types of magnet that Joseph Henry had invented, the faint currents make the relay act as a kind of switch. This switch controls a current from a battery. The current from the battery operates the receiver.

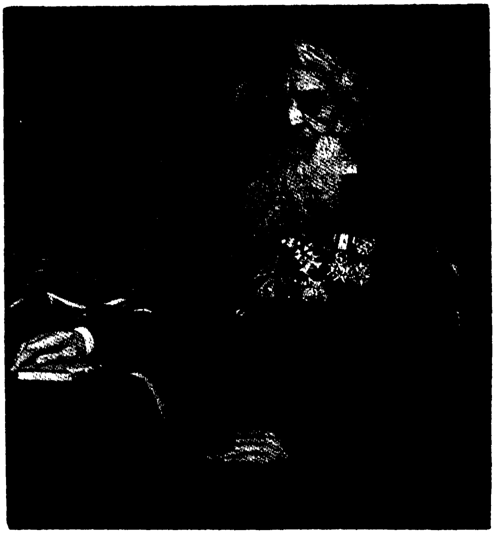
In the meantime, in 1838, a German named Steinheil had discovered that the earth itself would serve as a return wire for an electric current. All that was necessary was to bury the ends of the wires in the earth, or ground them, in order to complete the circuit. This made it much cheaper to construct and maintain the lines.



The original telegraphic instrument used by Morse.

The basic principles of the Morse telegraph remain the same today as in his first instrument, but the practical use of these principles has been vastly improved. Now, over a single pair of wires, ninety-six or more messages can be sent at the same time. The sending and receiving instruments are wonderfully complicated and work with lightning speed. A column of newspaper material can be sent in a few minutes, and there are devices which will send messages, such as weather or market reports, to scores of different places at the same time. Most of such improvements today are the work of many people in the great laboratories maintained by the large electrical companies.

Submarine telegraphy presented many entirely different problems from land telegraphy. The early submarine telegraphs beneath New York Harbor and under the English Channel were easy compared with the problem of crossing under the Atlantic Ocean. Of all the many men who designed and built the first Atlantic cable, the greatest was William Thomson, who later became Lord Kelvin. He was born in Belfast, Ireland, in 1824, and died in 1907. He was the son of a professor of mathematics, and when only eleven years old he was received as a student at Glasgow University. He afterward studied at Cambridge University and at Paris, and was made a professor in Glasgow University before he was twenty-three. All his life he worked on problems of the most difficult kind, relating to the strength, action and effects of electric currents under all conditions.



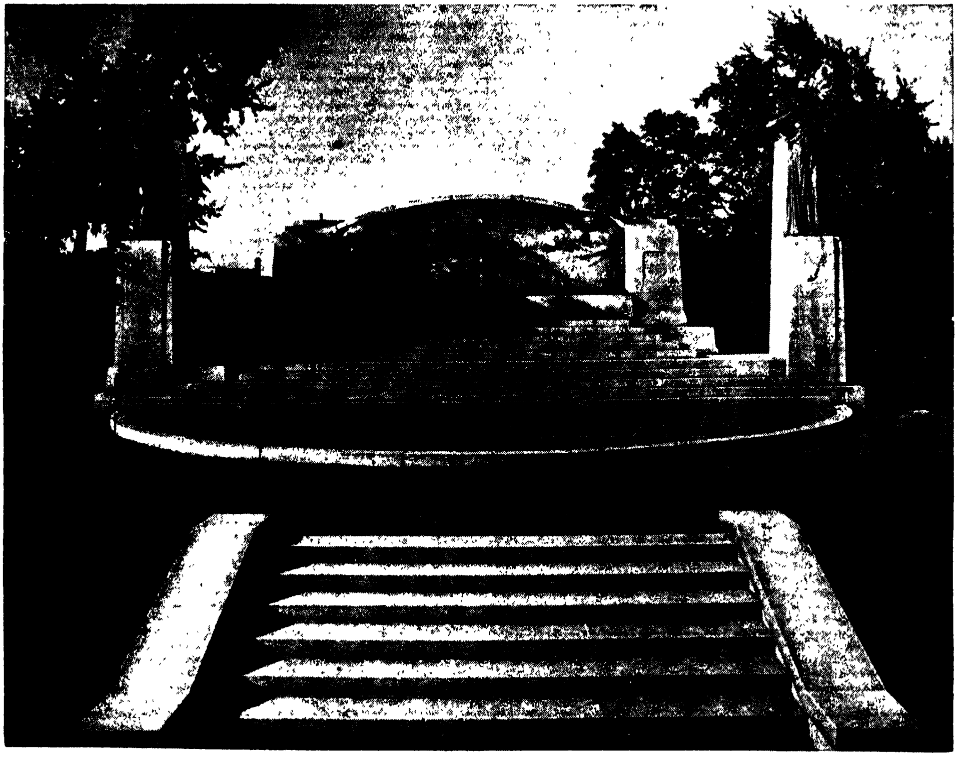
Samuel F. B. Morse with some of his many decorations.

Kelvin carried out the most delicate experiments in working on instruments for operating the Atlantic cable. From his experiments he was capable of working out mathematical conclusions which were beyond the reach of experiment. He was also of a practical turn of mind, as shown by his simple suggestion that woven copper wires be used in the core of the cable because they were less likely to break than a solid copper wire. Some of the most delicate of his devices are used today for receiving and recording wireless messages. The results of his experiments and researches and mathe-

THE BELL HOMESTEAD AND MONUMENT

Walker's Studio, Brantford

The Bell House at Brantford, in Ontario, where the Bell telephone was first conceived in 1874.



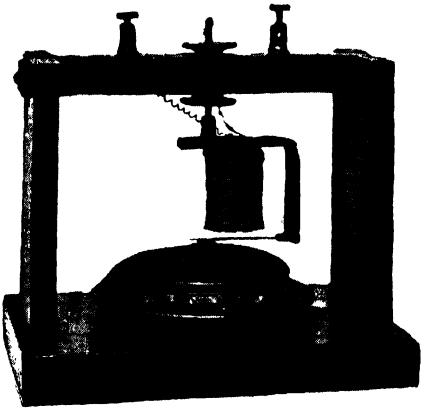
Walker's Studio, Brantford

This monument, erected in Brantford to Alexander Graham Bell, is the work of the noted sculptor Allward.

matical conclusions have been of the greatest benefit to nearly all branches of electricity as well as to submarine telegraphy.

THE USES OF ELECTRICITY IN THE NINETEENTH CENTURY

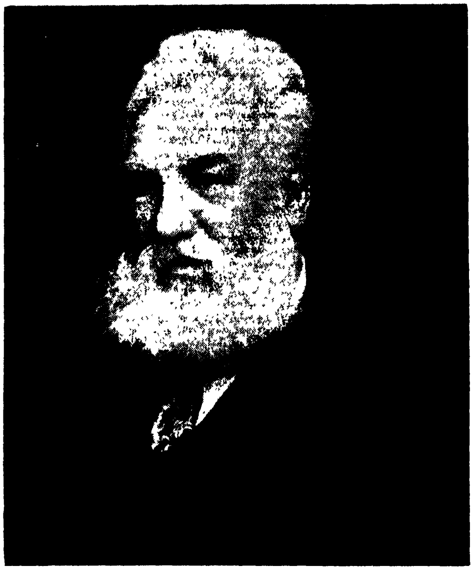
By the middle of the nineteenth century a great change had begun in scentific and technical education. The important educational institutions in Europe and America began to be better equipped with experimental laboratories, and later in the century the larger industries began having their own laboratories; all with more ample funds to carry on this kind of work. The dynamo and the electric motor became practical inventions, and electric lighting came into use. The uses of electricity spread rapidly.



A model of Bell's first telephone.

The next step in long-distance communication was the invention of the telephone. Many of the purely electrical problems had been solved by the time the telegraph was invented. The chief telephone problems were inventing a transmitter, to speak into, and a receiver, to listen to. Alexander Graham Bell was the first inventor of a telephone that would transmit the human voice. It was in 1876 that he filed his application for a patent. Much experimenting had been done before this by a number of men. In 1837, the year in which the telegraph was patented in the United States, an American, Dr. C. G. Page, published an essay on musical sound produced by an electromagnet at the instant the circuit was closed. That was the beginning of the idea that sound might be conducted over electric circuits.

The next step forward was taken in 1860 by Professor Philip Reis, of Friedrichsdorf, Germany, who discovered a principle of transmission which was later developed into a musical telephone. Philip Reis was born at Gelnhausen in 1834, the son of a baker. At an early age he showed remarkable gifts, and at ten was taking a keen interest in mathematics and science, and reading books in German, French, English, Latin and Italian. At sixteen he was studying mathematics, physics and natural history, with the intention of becoming a teacher. He accepted a teaching appointment at Friedrichsdorf in 1858; and he began investigating the transmission of sound.



Alexander Bell, the man who invented the telephone.

In the course of his researches the idea came to him of using a disc, set into vibration by sound-waves, to make and break an electrical circuit. The electric impulses were made to act on an electromagnet at the receiving station, which, as Dr. Page had discovered, gave out a sound with a pitch corresponding to the number of times the current was made and broken per second. Reis's idea was not only to reproduce musical notes at a distance, but also to reproduce the human voice. The extremely rapid making and breaking of the electric current failed to do this. It would reproduce the pitch of different notes, and the amplitude, that is, the loudness and softness, but it would not reproduce the quality which distinguishes one voice or one musical instrumany other important inventions, and in 1880 was made a member of the Royal Society of England.

THOMAS EDISON, ONE OF THE GREATEST INVENTORS OF ALL TIME

Perhaps the greatest single inventor in the field of electricity was Thomas Alva Edison, who was born in Ohio in 1847. He had very little schooling, and at the age of twelve was a train boy, selling newspapers, on a branch of the Grand Trunk Railway in Michigan. He saved the life of the son of a station agent, and the father taught him telegraphy. Edison became an expert operator, but he disliked routine work at any one place. While in Indianapolis in 1864, he invented an automatic telegraph repeater, the first of a long series of inventions and improvements. Later he invented a commercial stock indicator, which he sold to New York capitalists for $40,000. With this money he established a plant to manufacture electrical devices, and later on he opened his famous laboratory in New Jersey. He was a pioneer in the development of the large industrial research laboratories that now form an important part of all great industries. We tell you more about Edison on page 1891.

Brown Bros., New York

Marconi (above) helped to invent the wireless and ushered in the Age of Electronics.

Among the hundreds of Edison's inventions have been the phonograph, a telephone for long-distance transmission, a system of duplex telegraphy (later developed into four- and then six-message transmission), the carbon telephone transmitter and the incandescent electric light. The incandescent electric light is the basis upon which radio and television have been built up. Edison's inventions and improvements were so numerous, and so important, that it can be said that there are today scarcely any electrical appliances or apparatuses that he did not invent or improve or help to develop.

Edison used the induction coil, a device first used by Elisha Gray, to help solve the problem of long-distance telephoning. But still there were limits beyond which the voice would become too faint. The solving of this problem was the result of the work of Professor Michael Pupin of Columbia University. He invented devices, known as self-induction coils, which were located along the telephone wires to strengthen the current.

MICHAEL PUPIN, HIS WORK AND HIS BACKGROUND

Michael Pupin was born in Hungary in 1858, but his parents were natives of Serbia. His early education took place in Hungary and, later, in Prague, Bohemia. When he was sixteen years old he moved to the United States and, nine years later, graduated from Columbia University. Later on he studied at Cambridge University, in England, and at Berlin University. On his return to America he taught science at Columbia and specialized in electrical research and writing on scientific subjects. He died in 1935.

A new era in electrical transmission began with Marconi's invention of the wireless telegraph near the end of the nineteenth century. This paved the way for all the later developments in radio, wireless telephone, television, and other practical inventions in the field of electronics. The scientific basis for this invention had been formed by the mathematical theories of James Clerk-Maxwell, and by the scientific research and experiments of Heinrich Hertz.

Clerk-Maxwell was born in Edinburgh, Scotland, in 1831, and died in 1879. He achieved a fellowship at Cambridge University, where he made deep studies in the theory of electricity. He based his theories on the discoveries of Faraday and on such experiments as he was able to make at the time. By a brilliant course of reasoning, he announced that electrical impulses could be carried through the air without the help of wires, and that these waves of impulses were of various lengths, up to thousands of miles, and that they could be deflected and reflected like light-waves. Clerk-Maxwell did not have the laboratory apparatus to prove his theories.

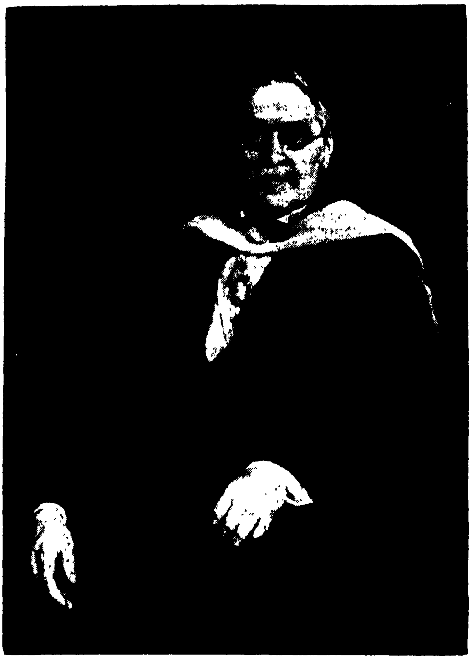
HEINRICH HERTZ PROVED THAT ELECTROMAGNETIC WAVES RESEMBLE LIGHT WAVES

Heinrich Hertz was born in Hamburg, Germany, in 1857, and died in 1894. He studied at the University of Berlin, and was later professor of physics in several German universities. His most important work was in showing that electricity can be sent through the air without wires, in electromagnetic waves, and that the actions of these waves are like those of light-waves as Clerk-Maxwell had predicted. Hertz' experiments went further to prove Faraday's and Clerk-Maxwell's theories, and gave Marconi the basis for the invention of his first wireless telegraph. These waves became known as Hertzian waves.

GUGLIELMO MARCONI, FATHER OF THE WIRELESS (RADIO)

Guglielmo Marconi, an Italian whose mother was Irish, was born in Bologna in 1874. From childhood his chief interest was in electricity, and he studied it at the University of Bologna. When he first read about the Hertzian waves, he saw at once that they could be used to send messages through the air without the help of wires, and he was astonished that no one had thought of doing so before. He began experimenting in his garden with simple instruments that he had made himself, and soon was able to send messages across the garden. Then he went into the country, where he succeeded in sending messages two miles.

He offered his discovery to the Italian Government, but the Government did not accept his offer. Marconi then wrote to Sir William Preece, head of the British Postal Service, and was invited to come to London. Marconi went to England, and you can judge of Sir William's astonishment when a slim youth of only twenty was ushered into his office as the scientist, Marconi, with whom he had been in correspondence.



Brown Bros., New York

Michael Pupin, electrical scientist, whose invention of self-induction coils improved the telephone.

In England Marconi went on with his experiments with great success. The British Government took the matter up, and his instruments were installed on a lightship on the Goodwin Sands. Next, wireless service was established between England and France, and some large ships were equipped with wireless telegraph. A station was built at Poldhu, in Cornwall, and messages were sent and received between it and incoming and outgoing ships.

MARCONI FLIES A KITE AND RECEIVES MESSAGES ACROSS THE OCEAN

Marconi then set out to prove that messages could be sent across the Atlantic. Instead of going to the expense of erecting a high tower on the coast of Newfoundland for his antenna, he flew a kite, and at the lower end of the wire that held the kite he attached his receiving instrument, which had a telephone receiver. By this means he was able to detect the signals sent out to him across the ocean, from Poldhu in England. This was in 1901. Improvements followed immediately, and Marconi took a prominent part in those developments. Just as Morse's telegraph in 1844 marked the beginning of the use for practical purposes of electricity carried over wires, so Marconi's invention marked the beginning of the practical use of messages carried over electrical waves without wires. In fact it was the beginning of our Age of Electronics.

Scientists and inventors almost at once began experiments to develop wireless telephony. We have said that Edison's incandescent light bulb was important in the development of wireless, or radio. In some of his hundreds of experiments, Edison had placed a small metal plate in the bulb, separated from the hot filament by a narrow gap; and he had found that when the plate was positively charged a tiny stream of energy leaped across the gap and set up a frail electric circuit. This became known as the Edison effect, and we now know that this stream of energy is made up of electrons.

THE DIFFICULT PROBLEM OF DEVELOPING A WIRELESS TELEPHONE

Edison had done nothing further with this experiment, but when the experimenters began to work on the wireless telephone, Professor J. A. Fleming, of England, built the Edison effect into a bulb which would detect wireless waves. But it would not amplify them. Fleming discovered, however, that the stream of electrons shot out by this arrangement would offer a path for the tiny currents picked up by a wireless receiving instrument. Professor Reginald A. Fessenden, in America, was able to send sound over a distance of 200 miles; and later Major Majorana, of Italy, transmitted sounds over a wireless telephone from Rome to Sicily. However, there was still no wireless telephone that could be talked over. Inventors had solved many problems leading up to that, and had showed that sound could be sent by wireless waves as well as by wire. But wireless telephone needed special transmitting and receiving devices that would convey the human voice.

LEE DE FOREST MAKES AN ELECTRON TUBE, AND RADIO SURGES FORWARD

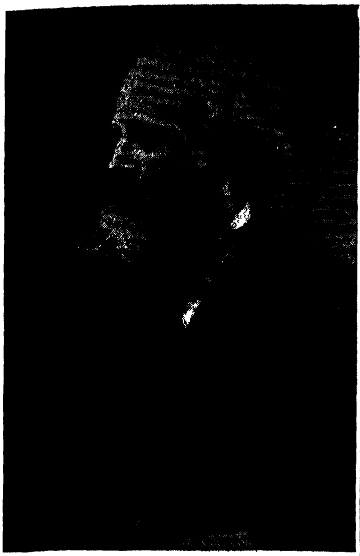
It remained for Lee De Forest to invent the audion tube, or electron tube, that would make possible the wireless telephone, radio and television, and other electronics devices. De Forest was born in Council Bluffs, Iowa, in 1873. From his early childhood he was absorbed in invention, and he built many different electrical devices, including an electroplating outfit, motors, batteries and the like. He attended Sheffield Scientific School at Yale University, where he was a brilliant student, but as he was very poor, he was rather reserved and not very sociable. He went through the course in three years, and then took a further course in electrical engineering. He became very much interested in Hertzian waves, and this led him to an intense interest in what is now called electronics. He did a great deal of experimenting and sometimes almost starved in order to save money to carry on his experiments. When the Spanish-American War broke out in 1898 he enlisted in the army, and when the war was over he returned to Yale to study for a Ph.D. degree, taking lectures from Josiah Willard Gibbs, the famous mathematician.

After leaving Yale, De Forest spent poverty-stricken years, devoting all his spare time to working on electronics. His first invention of note was an automatic detector of wireless signals, a great improvement over the ones then in use. He was successful in setting up and operating wireless stations, and did some work of this kind for the United States Navy, but he was no business man and soon became bankrupt. He pioneered in establishing wireless service between England and Ireland, and set up a station at Shantung, China. In the meantime he had been working on the idea of a device for transmitting the voice over the wireless telephone.

THE GRID IN DE FOREST'S TUBE ACTS AS ELECTRON POLICEMAN

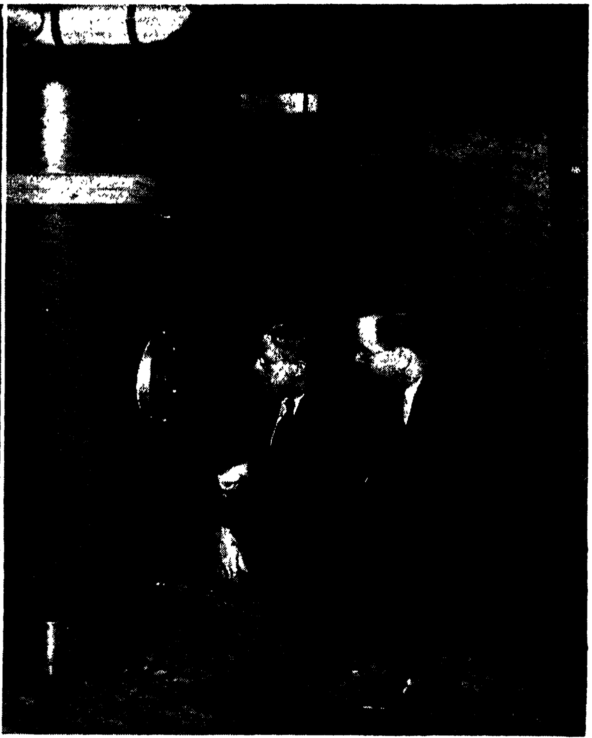
While working in the Western Electric Company laboratory in Chicago, De Forest noticed that the gas light in the room brightened and dimmed when he operated a transmitter coil. This gave him the idea that the flame within the gas mantle could be used to detect electric waves. With this as a clue, he carried on a series of experiments, but got no results. The experiments, however, led him to substitute an electric bulb for the gas light, and to arrange a metal plate near the filament, as Edison had done years before. Then he tried placing another element in various positions in the bulb, so as to try to control the flow of electrons from the filament to the plate. Finally he hit upon the idea of using a piece of platinum

LEADERS IN THE FIELD OF ELECTRONICS



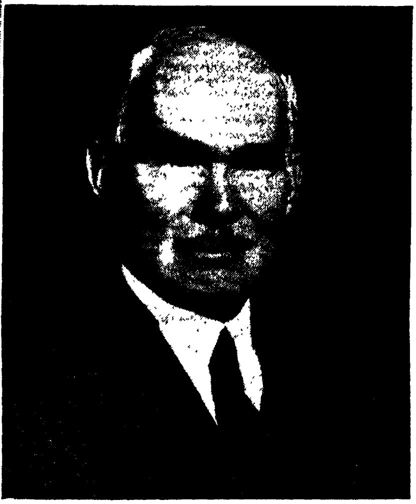
Brown Bros., New York

James Clerk-Maxwell. His great work, ELECTRICITY AND MAGNETISM appeared in 1873. It helped men to understand what electricity is.



Irving Langmuir, shown above with J. J. Donovan, is noted for his studies of electrons and their behavior.

Dr. V. K. Zworykin, R.C.A. television pioneer. He is holding an Image Orthicon tube, which is used in airborne television, relayed from planes in the air.



Both pictures, R.C.A., New York

Lee De Forest has made more than 300 inventions. Most important is the audion tube, or "radio tube." This is used not only in radio, radar and television, but also in many fields of industry, for the remote control of machinery.

wire, bent back and forth to form a shape like a kitchen grid, and that gave the result that he wanted. This was the first electron tube. The lead-wire from the radio aerial attached to the grid brings in only a tiny amount of electrical energy, but enough to cause the grid to vary the flow of electrons from the lamp. We shall not go into the mechanism of the electron tube here, as it is described eleswhere. With many improvements, and by hooking up several tubes in series, De Forest proved that any amount of amplification could be obtained. This was the result that all of the other experimenters had been trying to get.

In 1915 De Forest was hailed into court on charges of using the United States mails to defraud the public. It seems that he had started to sell stock to finance a company to put his new wireless telephone into use. The prosecuting attorney at the trial held up a small glass tube about the size of an electric light bulb, with wires sticking out of it, and denounced De Forest as a crook and an impostor for trying to make investors believe that such a worthless device would enable people to talk across the Atlantic Ocean, and for persuading these foolish people to buy stock in his company. Two of the men associated with De Forest in selling the stock were convicted, but De Forest himself was released with a severe scolding from the judge.

Two years later, this "worthless" device did carry the human voice across the Atlantic Ocean. What the court had condemned as a fake was the audion tube; the greatest single invention of this century, and the basis of an electronic industry now worth several billion dollars. De Forest did not realize the tremendous commercial value of his tube. He was no promoter or business man, and to others went the greater profits.

SOME OF THE USES OF THE AUDION TUBE

This tube is used in radio, long-distance and wireless telephony, telephoto, talking movies, radar and television. In addition it is used in the form of the pliatron for heating materials quickly and evenly with high-frequency radio waves. It is also used in other forms for many purposes that give remote control of machinery and other mechanisms. De Forest has made more than 300 inventions, including the three-electrode (radio) tube, used as a radio detector. He almost rivals Edison in the number and variety of his inventions and improvements.

Frequency modulation, usually called FM, was the discovery of Major Edwin H. Armstrong, who has also done a great deal of work on television. FM is a method of radio broadcasting and receiving which almost entirely does away with static and other such defects which are present in amplitude modulation, or AM. Eventually FM will probably take the place of AM for general broadcasting, but such a change-over can not take place all at once.

MEN WHO HAVE WORKED ON TELEVISION

Many scientists and inventors have contributed to television. The researches and discoveries of Clerk-Maxwell, Hertz, Marconi, Lee De Forest, E.F.W. Alexanderson, Irving Langmuir, Philo Farnsworth and many others have been necessary to bring television to its present practical success. As early as 1884 a German, Paul Nipkow, invented what is called the scanning disc. This was later replaced by a moving electron beam. The chief developments that have made television practical have been the inventions of Dr. Vladimir K. Zworykin—the iconoscope and the kinescope. (See the chapter on Television.)

Vladimir Zworykin was born in Russia in 1889, he graduated from the Petrograd Institute of Technology in electrical engineering, and later studied in Paris. During the first World War he served in the Russian Army Radio Corps. He moved to the United States in 1919, and became an American citizen in 1924. During the 1920's he worked in the laboratories of the Westinghouse Electric Company, and since 1929 he has been with the laboratories of the Radio Corporation of America, where he developed the iconoscope and the kinescope in the early 1930's.

We may say that there have been, so far, four great personages who, in practical invention, have established four marked epochs in the growth of long-distance communication. These are: Morse, with the telegraph; Bell, with the telephone; Marconi, with wireless telegraphy; and De Forest, with the electronic tube that has given us radio and television. Yet these men, great as they were, owe much to the work and discoveries of hundreds of other scientists and inventors who helped to point the way, and to the thousands of technicians who have made detailed improvements in these great inventions.

THE NEXT STORY OF MEN AND WOMEN IS ON PAGE 6293.

POETRY OF THE TWENTIETH CENTURY

Illustrated by Roger Duvoisin

Lincoln, the Man of the People[*]

By Edwin Markham
(1852-1940)

When the Norn Mother saw the Whirlwind Hour
Greatening and darkening as it hurried on,
She left the Heaven of Heroes and came down
To make a man to meet the mortal need.
She took the tried clay of the common road—
Clay warm yet with the genial heat of earth,
Dashed through it all a strain of prophecy;
Tempered the heap with thrill of human tears;
Then mixed a laughter with the serious stuff.
Into the shape she breathed a flame to light
That tender, tragic, ever-changing face;
And laid on him a sense of the Mystic Powers,
Moving—all hushed—behind the mortal veil.
Here was a man to hold against the world,
A man to match the mountains and the sea.

The color of the ground was in him, the red earth;
The smack and tang of elemental things:
The rectitude and patience of the cliff;
The good-will of the rain that loves all leaves;
The friendly welcome of the wayside well;
The courage of the bird that dares the sea;
The gladness of the wind that shakes the corn;
The pity of the snow that hides all scars;
The secrecy of streams that make their way
Under the mountain to the rifted rock;
The tolerance and equity of light
That gives as freely to the shrinking flower
As to the great oak flaring to the wind—
To the grave's low hill as to the Matterhorn
That shoulders out the sky. Sprung from the West,
He drank the valorous youth of a new world.
The strength of virgin forests braced his mind,
The hush of spacious prairies stilled his soul.
His words were oaks in acorns; and his thoughts
Were roots that firmly gripped the granite truth.

Up from log cabin to the Capitol,
One fire was in his spirit, one resolve—
To send the keen ax to the root of wrong,
Clearing a free way for the feet of God,
The eyes of conscience testing every stroke,
To make his deed the measure of a man.
He built the rail-pile as he built the state,
Pouring his splendid strength through every blow:
The grip that swung the ax in Illinois
Was on the pen that set a people free.

So came the Captain with the mighty heart.
And when the judgment thunders split the house,
Wrenching the rafters from their ancient rest,
He held the ridgepole up, and spiked again
The rafters of the Home. He held his place—
Held the long purpose like a growing tree—
Held on through blame and faltered not at praise.
And when he fell in whirlwind, he went down
As when a lordly cedar, green with boughs,
Goes down with a great shout upon the hills,
And leaves a lonesome place against the sky.

Mending Wall[**]

By Robert Frost (1875-   )

Something there is that doesn't love a wall,
That sends the frozen ground-swell under it,
And spills the upper boulders in the sun;
And makes gaps even two can pass abreast.
The work of hunters is another thing:
I have come after them and made repair
Where they have left not one stone on stone,
But they would have the rabbit out of hiding,
To please the yelping dogs. The gaps I mean,
No one has seen them made or heard them made,
But at spring mending-time we find them there.

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[*] By permission of Edwin Markham.

[**] From Collected Poems, by Robert Frost. Reprinted by permission of Henry Holt and Co.

I let my neighbor know beyond the hill;
And on a day we meet to walk the line
And set the wall between us once again.
We keep the wall between us as we go—
To each the boulders that have fallen to each.
And some are loaves and some so nearly balls
We have to use a spell to make them balance:
"Stay where you are until our backs are turned!"
We wear our fingers rough with handling them.
Oh, just another kind of out-door game,
One on a side—it comes to little more.
There where it is we do not need the wall:
He is all pine and I am apple orchard.
My apple trees will never get across
And eat the cones under his pines, I tell him.
He only says, "Good fences make good neighbors."
Spring is the mischief in me, and I wonder
If I could put a notion in his head:
"Why do they make good neighbors? Isn't it
Where there are cows? But here there are no cows.
Before I built a wall I'd ask to know
What I was walling in or walling out,
And to whom I was like to give offence.
Something there is that doesn't love a wall,
That wants it down." I could say "Elves" to him,
But it's not elves exactly, and I'd rather
He said it for himself. I see him there
Bringing a stone grasped firmly by the top
In each hand, like an old-stone savage armed.
He moves in darkness as it seems to me,
Not of woods only and the shade of trees.
He will not go behind his father's saying,
And he likes having thought of it so well
He says again, "Good fences make good neighbors."

Here Lies a Lady*

By John Crowe Ransom (1888-)

Here lies a lady of beauty and high degree.
Of chills and fever she died, of fever and chills,
The delight of her husband, her aunts, an infant of three,
And of medicos marvelling sweetly on her ills.

For either she burned, and her confident eyes would blaze,
And her fingers fly in a manner to puzzle their heads—
What was she making? Why, nothing; she sat in a maze
Of old scraps of laces, snipped into curious shreds—

Or this would pass, and the light of her fire decline
Till she lay discouraged and cold as a thin stalk white and blown,
And would not open her eyes, to kisses, to wine;
The sixth of these states was her last; the cold settled down.

Sweet ladies, long may ye bloom, and toughly I hope ye may thole,
But was she not lucky? In flowers and lace and mourning,
In love and great honor we bade God rest her soul
After six little spaces of chill, and six of burning.

---

*From Chills and Fever, by John Crowe Ransom. By permission of Alfred A. Knopf, Inc.

Talking in Their Sleep*

By EDITH M. THOMAS (1854-1925)

You think I am dead,
The apple tree said,
Because I have never a leaf to show—
Because I stoop,
And my branches droop,
And the dull gray mosses over me grow!
But I'm all alive in trunk and shoot;
The buds of next May
I fold away—
But I pity the withered grass at my root.

You think I am dead,
The quick grass said,
Because I have parted with stem and blade!
But under the ground
I am safe and sound,
With the snow's thick blanket over me laid.
I'm all alive and ready to shoot
Should the spring of the year
Come dancing here—
But I pity the flower without branch or root.

You think I am dead,
A soft voice said,
Because not a branch or root I own!
I never have died,
But close I hide
In a plumy seed that the wind has sown.
Patient I wait through the long winter hours;
You will see me again—
I shall laugh at you then,
Out of the eyes of a hundred flowers.

---

*By permission of, and special arrangement with, Houghton Mifflin Company.

Recuerdo*

By EDNA ST. VINCENT MILLAY
(1892-)

We were very tired, we were very merry—
We had gone back and forth all night on the ferry.
It was bare and bright, and smelled like a stable—
But we looked into a fire, we leaned across a table,
We lay on a hill-top underneath the moon;
And the whistles kept blowing, and the dawn came soon.

We were very tired, we were very merry—
We had gone back and forth all night on the ferry;
And you ate an apple, and I ate a pear,
From a dozen of each we had bought somewhere;
And the sky went wan, and the wind came cold,
And the sun rose dripping, a bucketful of gold.

We were very tired, we were very merry,
We had gone back and forth all night on the ferry.
We hailed, "Good-morrow, mother!" to a shawl-covered head,
And bought a morning paper, which neither of us read;
And she wept, "God bless you!" for the apples and pears,
And we gave her all our money but our subway fares.

---

*From A Few Figs from Thistles, published by Harper and Brothers, copyright, 1922, by Edna St. Vincent Millay.

The Daniel Jazz*

By VACHEL LINDSAY (1879-1931)

Lindsay thought poetry should be chanted or read aloud, if possible, with a musical background. Here he caught the spirit of the old time Negro revivalist preaching.

DARIUS the Mede was a king and a wonder.
His eye was proud, and his voice was thunder.
He kept bad lions in a monstrous den.
He fed up the lions on Christian men.

Beginning with a strain of "Dixie."

Daniel was the chief hired man of the land.
He stirred up the jazz in the palace band.
He whitewashed the cellar. He shovelled in the coal.
And Daniel kept a-praying:—"Lord save my soul."
Daniel kept a-praying "Lord save my soul."
Daniel kept a-praying "Lord save my soul."

With a touch of "Alexander's Ragtime Band."

Daniel was the butler, swagger and swell.
He ran upstairs. He answered the bell.
And he would let in whoever came a-calling:—
Saints so holy, scamps so appalling.
"Old man Ahab leaves his card.
Elisha and the bears are a-waiting in the yard.
Here comes Pharaoh and his snakes a-calling.
Here comes Cain and his wife a-calling.
Shadrach, Meshach and Abednego for tea.
Here comes Jonah and the whale,
And the Sea!
Here comes St. Peter and his fishing pole.
Here comes Judas and his silver a-calling.
Here comes old Beelzebub a-calling."
And Daniel kept a-praying:—"Lord save my soul."
Daniel kept a-praying:—"Lord save my soul."
Daniel kept a-praying:—"Lord save my soul."

His sweetheart and his mother were Christian and meek.
They washed and ironed for Darius every week.
One Thursday he met them at the door:—
Paid them as usual, but acted sore.

He said:—"Your Daniel is a dead little pigeon.
He's a good hard worker, but he talks religion."
And he showed them Daniel in the lions' cage.
Daniel standing quietly, the lions in a rage.
His good old mother cried:—
"Lord save him."
And Daniel's tender sweetheart cried:—
"Lord save him."
And she was a golden lily in the dew.
And she was as sweet as an apple on the tree,
And she was as fine as a melon in the corn-field,
Gliding and lovely as a ship on the sea,
Gliding and lovely as a ship on the sea.

And she prayed to the Lord:—
"Send Gabriel. Send Gabriel."

---

*From Collected Poems of Vachel Lindsay: by permission of the publishers, The Macmillan Company.

King Darius said to the lions:—
"Bite Daniel. Bite Daniel.
Bite him. Bite him. Bite him!"

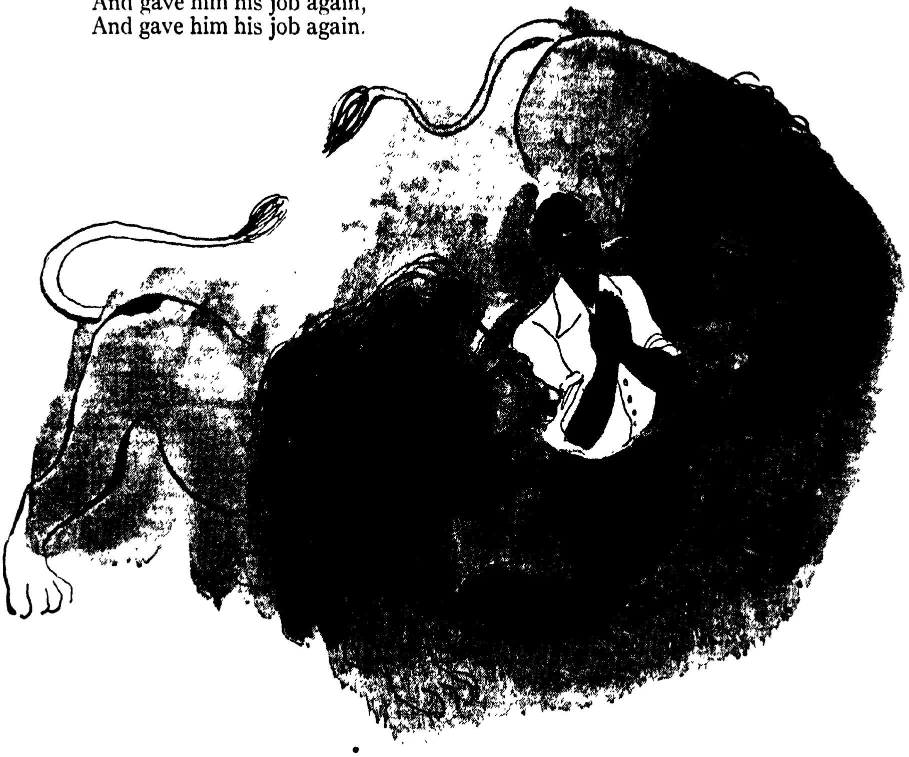
Thus roared the lions:—
"We want Daniel, Daniel, Daniel,
We want Daniel, Daniel, Daniel.
Grrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr
Grrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr"

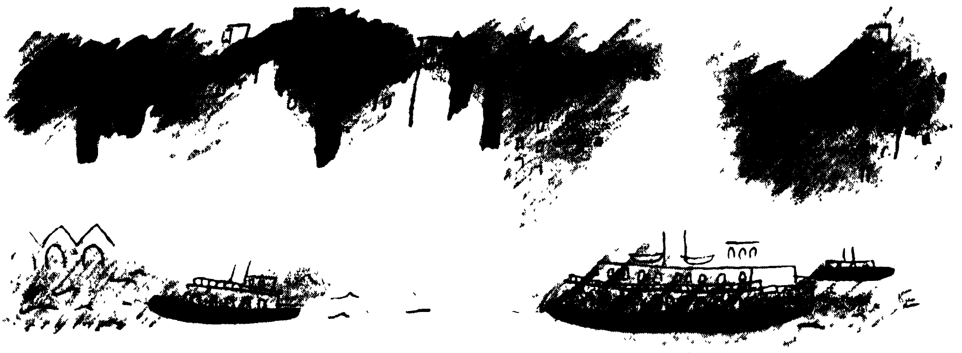
Here the audience roars.

And Daniel did not frown,
Daniel did not cry.
He kept on looking at the sky.
And the Lord said to Gabriel:—
"Go chain the lions down,
Go chain the lions down.
Go chain the lions down."

The audience sings this with the leader, to the old Negro tune.

And *Gabriel* chained the lions,
And *Gabriel* chained the lions,
And *Gabriel* chained the lions,
And Daniel got out of the den,
And Daniel got out of the den,
And Daniel got out of the den.
And Darius said:—"You're a Christian child,"
Darius said:—"You're a Christian child,"
Darius said:—"You're a Christian child,"
And gave him his job again,
And gave him his job again,
And gave him his job again.





Miniver Cheevy[*]

By Edwin A. Robinson (1869-1935)

Miniver Cheevy, child of scorn,
Grew lean while he assailed the seasons;
He wept that he was ever born,
And he had reasons.

Miniver loved the days of old
When swords were bright and steeds were prancing;
The vision of a warrior bold
Would set him dancing.

Miniver sighed for what was not,
And dreamed, and rested from his labors;
He dreamed of Thebes and Camelot,
And Priam's neighbors.

Miniver mourned the ripe renown
That made so many a name so fragrant;
He mourned Romance, now on the town,
And Art, a vagrant.

Miniver loved the Medici,
Albeit he had never seen one;
He would have sinned incessantly
Could he have been one.

Miniver cursed the commonplace
And eyed a khaki suit with loathing;
He missed the medieval grace
Of iron clothing.

Miniver scorned the gold he sought,
But sore annoyed was he without it;
Miniver thought, and thought, and thought,
And thought about it.

Miniver Cheevy, born too late,
Scratched his head and kept on thinking;
Miniver coughed, and called it fate,
And kept on drinking.

The Fog[*]

By Carl Sandburg (1878-   )

The fog comes
on little cat feet.

It sits looking
over harbor and city
on silent haunches
and then moves on.

Compensation[**]

By Paul Laurence Dunbar (1872-1906)

Because I had loved so deeply,
Because I had loved so long,
God in His great compassion
Gave me the gift of song.

Because I have loved so vainly,
And sung with such faltering breath,
The Master, in infinite mercy,
Offers the boon of Death.

Ann Rutledge

By Edgar Lee Masters (1869-   )

Out of me unworthy and unknown
The vibrations of deathless music!
"With malice toward none, with charity for all,"
Out of me forgiveness of millions toward millions,
And the beneficient face of a nation
Shining with justice and truth.
I am Ann Rutledge who sleep beneath these weeds,
Beloved of Abraham Lincoln,
Wedded to him, not through union,
But through separation.
Bloom forever, O Republic,
From the dust of my bosom!

---

[*] From Town Down the River, by E. A. Robinson. By permission of Charles Scribner's Sons.

[*] From Chicago Poems, by Carl Sandburg, permission of Henry Holt & Co.

[**] From The Poems of Paul Laurence Dunbar, permission of Dodd, Mead & Co.

I Lived My Days Apart

By SIEGFRIED SASSOON (1886-)

I LIVED my days apart,
Dreaming fair songs for God,
By the glory in my heart
Covered and crowned and shod.

Now God is in the strife,
And I must seek Him there,
Where death outnumbers life
And fury smites the air.

I walk the secret way
With anger in my brain.
O music through my clay
When will you sound again?

Velvet Shoes*

By ELINOR WYLIE (1885-1928)

LET us walk in the white snow
In a soundless space;
With footsteps quiet and slow,
At a tranquil pace,
Under veils of white lace.

I shall go shod in silk,
And you in wool,
White as a white cow's milk,
More beautiful
Than the breast of a gull.

We shall walk through the still town
In a windless peace;
We shall step upon white down,
Upon silver fleece
Upon softer than these.

We shall walk in velvet shoes:
Wherever we go
Silence will fall like dews
On white silence below.
We shall walk in the snow.

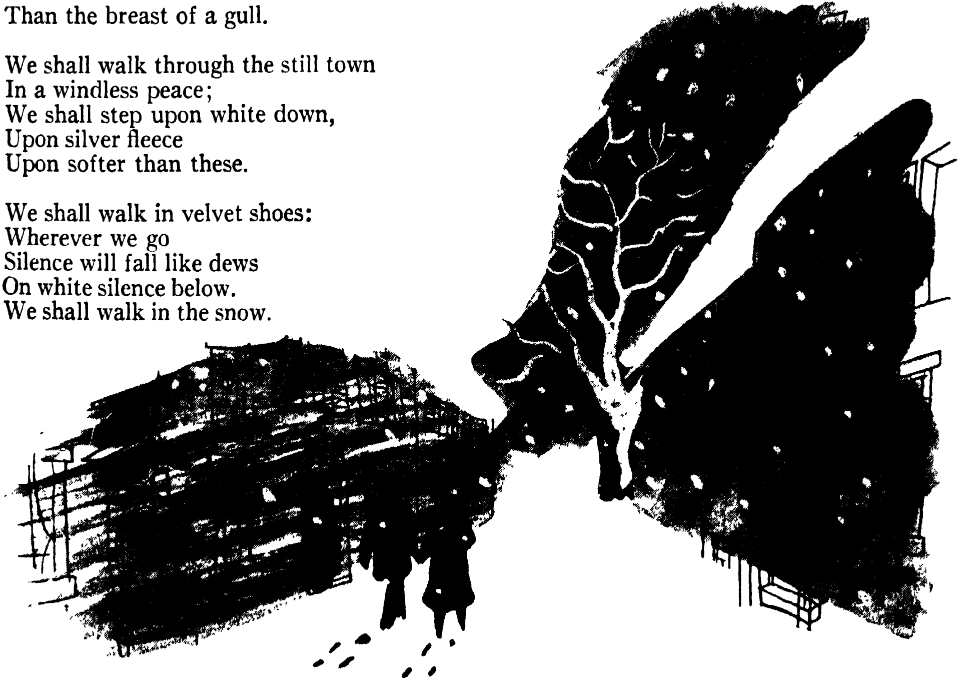
Cargoes**

By JOHN MASEFIELD (1878-)

QUINQUIREME of Nineveh from distant Ophir,
Rowing home to haven in sunny Palestine,
With a cargo of ivory,
And apes and peacocks,
Sandalwood, cedarwood, and sweet white wine.

Stately Spanish galleon coming from the Isthmus,
Dipping through the Tropics by the palm-green shores,
With a cargo of diamonds,
Emeralds, amethysts,
Topazes, and cinnamon, and gold moidores.

Dirty British coaster with a salt-caked smoke-stack,
Butting through the channel in the mad March days,
With a cargo of Tyne coal,
Road-rails, pig-lead,
Firewood, iron-ware, and cheap tin trays.



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*From The Collected Poems of Elinor Wylie, by permission of the publishers, Alfred A. Knopf, Inc.

**From Poems, by John Masefield. By permission of the publishers, The Macmillan Company.

Leisure

By William H. Davies (1870-1940)

What is this life if, full of care,
We have no time to stand and stare?

No time to stand beneath the boughs
And stare as long as sheep or cows.

No time to see, when woods we pass,
Where squirrels hide their nuts in grass.

No time to see, in broad daylight,
Streams full of stars, like skies at night.

No time to turn at Beauty's glance,
And watch her feet, how they can dance.

No time to wait till her mouth can
Enrich that smile her eyes began.

A poor life this if, full of care,
We have no time to stand and stare.

The Reed-Player*

By Archibald MacLeish (1892-   )

A hollow reed against his lips
He played a soaring strain,
That fled his dancing finger-tips
Light as a swallow wheels and dips
Above the flowing grain.

The Song of Songs it was, strange wrought
Beyond the heather hills
From memories and dreams, and taught
By shepherd women who had caught
Its lilt from mountain rills.

The beating of a heart I heard
In that forlorn sweet air,
The singing of a distant bird,
A sigh, a softly uttered word
And echoed laughter there.

"Play me a song of Death," I whispered then.
He raised his hollow reed as one who longs
To turn to dreams, and smiled, and played again,
The Song of Songs.

The Buckle*

By Walter de la Mare (1873-   )

I had a silver buckle,
I sewed it on my shoe,
And 'neath a sprig of mistletoe
I danced the evening through!

I had a bunch of cowslips,
I hid them in a grot
In case the elves should come by night
And me remember not.

I had a yellow riband,
I tied it in my hair
That, walking in the garden,
The birds might see it there.

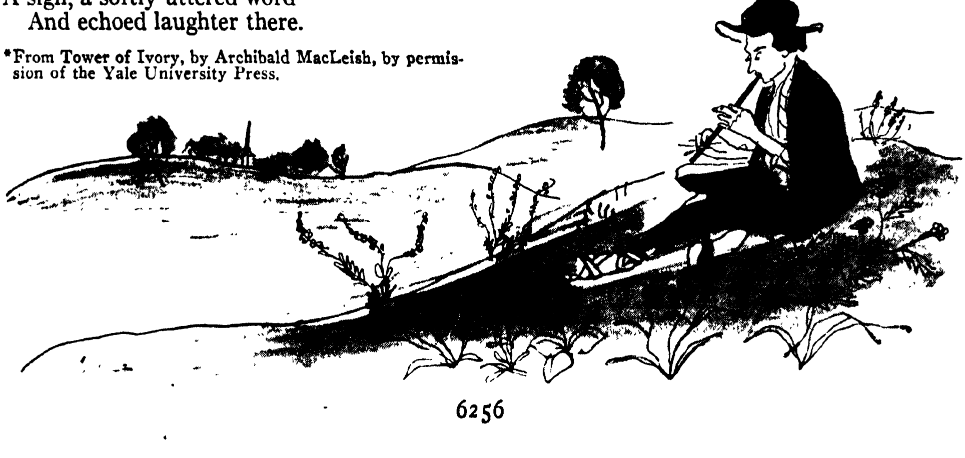
I had a secret laughter,
I laughed it near the wall;
Only the ivy and the wind
May tell of it at all.

An Epitaph*

By Walter de la Mare (1873-   )

Here lies a most beautiful lady,
Light of step and heart was she:
I think she was the most beautiful lady
That ever was in the West Country.
But beauty vanishes; beauty passes;
However rare, rare it be;
And when I crumble who shall remember
This lady of the West Country?

THE NEXT POEMS ARE ON PAGE 6647.



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*From Tower of Ivory, by Archibald MacLeish, by permission of the Yale University Press.

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In an eighteenth century cabinet maker's shop.

THE ART OF FURNITURE-MAKING

CHAIRS and tables, tables and chairs—although we all have them and use them, we seldom think about them so long as they fit into our needs and make for our comfort. But you may meet a person some day who will glance at a chair-back or a table-leg and murmur a name—"Chippendale," "Hepplewhite," "Sheraton" or "Duncan Phyfe." You may hear of a "Queen Anne house," an "Adam room," or an "Empire room." And what does it all mean? Simply that there have been various styles in furniture and decoration and that each style is known by some particular name—the name of a ruler or a government or of a man who has had force and originality enough to introduce a style of his own designing.

If you think back to very early times you will realize that furniture was not always a convenience. Suppose that you belonged to an ancient pastoral tribe, living in tents and moving often to fresh fields on which to pasture the flocks. Tents and cooking utensils would be about as much paraphernalia as could be carried about without too much trouble. But simplicity and sparseness in furnishing do not of necessity go hand in hand with lack of beauty. The shepherd folk of the East wove richly colored rugs to carpet their tents, and handsome hangings to please the eye with loveliness of hue and design. The camel-cloths and other trappings of their beasts of travel were made attractive with decoration.

Modern European (and American) civilization has made us feel the need of many kinds of furniture. If you lived in a cave you would sit down on a stone or a log; but in a house you look for a chair or a sofa. If you have a book to dispose of, you turn to a table, a desk or a bookshelf. If you have a garment to lay aside, you expect to find a place for it in a drawer. When you are tired, there must be a bed to rest upon. When meal-time comes, you take your place at a dining-table set with dishes and silver.

Because furniture is first of all intended for use and convenience in daily life, it ought always to be useful and convenient; but it may, besides, count as a part of our education. If we live in the midst of ugly surroundings and grow used to the sight of unlovely, inartistic objects, these may influence our taste so that we shall not be quick to recognize and appreciate really fine and beautiful things. Now and then someone is born who feels this so deeply and who loves beauty so intensely that he spends his life trying to reform general taste and working to make homes beautiful. We shall tell you about some of these men.

First we shall think of England just about two hundred years ago. By that time its furniture had already passed through many changes. That of the Saxons had been rather barbarous and rough; that brought in by the Normans was elaborate and heavy; later periods had felt the influence of changing styles on the continent of Europe, particularly in France and the Low Countries. This came about quite naturally. For instance, when the Italian Renaissance ushered in more beautiful and practical furniture—furniture that could be moved about—the fashion crept across Europe through France and by way of Spain into Spain's dominions of the Low Countries, directly across the Channel from England. Presently English furnishings were taking on a Renaissance air. By the time of Queen Elizabeth tables were changing from the simple "board" laid upon trestles to a substantial long slab of solid wood supported on sturdy legs at the corners, with a foot-rail connecting the legs at the base. Chairs were still heavy and not very common, the less important folk having to sit upon forms and settles or stools.

FURNITURE LESS HEAVY AND IN GREATER VARIETY THAN BEFORE

When the Stuarts were ruling, especially when they came back from France after the Commonwealth, or Cromwellian period, French and Flemish elements became very noticeable in English styles. There was greater variety in furniture, and it was made less heavy and cumbersome. Marquetry, or inlay of ebony, ivory, mother-of-pearl and other materials, was admired in decoration. Tapestries and embroideries were much used for covers on upholstered chairs. Some of the smaller tables had "gate-legs" to hold up side leaves, and among the chairs there were some handsome designs with backs of carved oak framework surrounding narrow panels of cane. These appeared in what is known as the Restoration era.

Then came the Dutch ruler, William of Orange, during whose reign it was natural that Dutch and Flemish ideas should take the lead. But at the same time, among the Huguenots fleeing from France to England came Frenchmen who were designers and workers in wood. Moreover, from far-away China traders were bringing lacquered cabinets and other Chinese objects, which became very much the fashion. So styles followed one after another and clashed or mingled, until in Queen Anne's reign a more truly English mode seemed to be forming amid all this strange jumble of foreign contributions. One kind of chair very much liked in her day had a simply shaped carved splat up the middle of the back, and from this was called a "fiddle-back" chair.

SORTS OF WOOD USED IN THE EIGHTEENTH CENTURY

Until the middle of the sixteen hundreds, that is, until after the days of Cromwell in England, furniture was seldom made of any wood but oak—strong, dark, substantial, lasting for generations. Then as more intricate carving was introduced, walnut took the first place, keeping in the lead until about 1725, the period we have reached in our story. Mahogany was the favorite wood for handsome furniture during the whole century that followed, although satinwood, pear, tulipwood, ebony and others were used often for inlay work, and satinwood sometimes was chosen for the whole frame. Painted and lacquered, or japanned, surfaces, too, were popular at times.

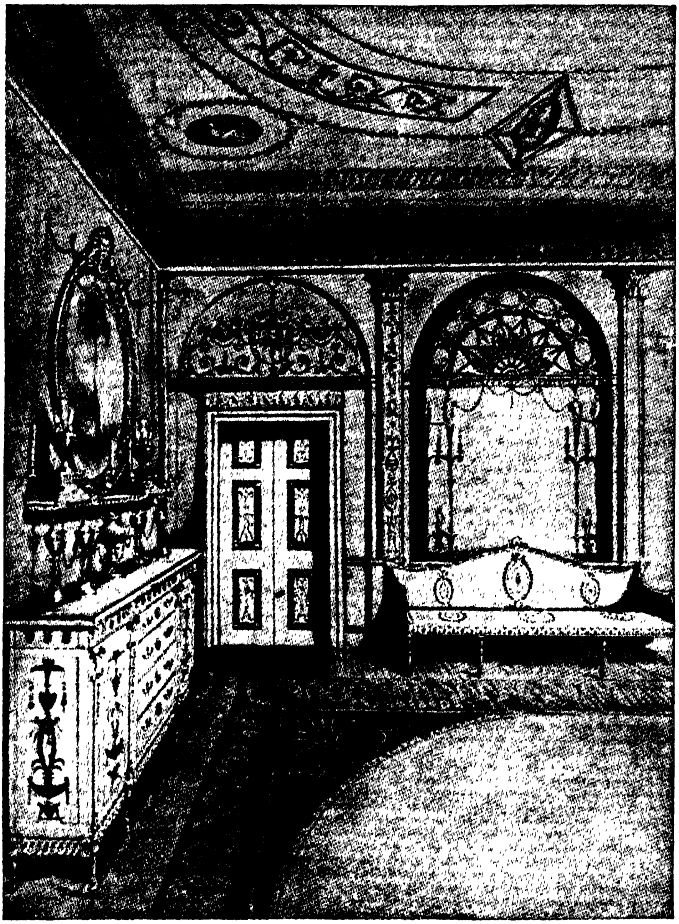
Before the end of Queen Anne's reign there was born in England one who before his death, in 1779, was to lay a strong guiding hand upon the furniture designs of his native land. By 1727, when George I was king, a young man, Thomas Chippendale, with his father — also Thomas — who was a cabinet-maker, had moved to London. There the business started by the father was carried on by the son with such success that "Chippendale" furniture, whether made by him or by others following his designs, has become familiar all around the globe. And why? Because, instead of just frowning over qualities he disliked in the furniture then in use, he dared to start making furniture according to his own taste and ideals. Without losing sight of the fact that an article must be built for strength and service, he aimed to combine those qualities with greater grace and lightness than had been known before; and the result in his best work was solidity without heaviness. With the skill of a true artist

JOSHUA REYNOLDS CALLS ON CHIPPENDALE

Many famous persons met in Chippendale's workshop in St. Martin's Lane, London. Here the great painter Sir Joshua Reynolds is seen talking to the master of furniture craft.

he could gather together a variety of ideas and weave them into a harmonious original plan which showed the impress of his own personality. At different times he made use of Gothic, French, Dutch, classic and even Chinese elements, and usually the pieces he produced had beauty and distinction. In his later years, however, he was tempted to mix styles too unrelated to each other, with results that were grotesque. At carving he was always a master.

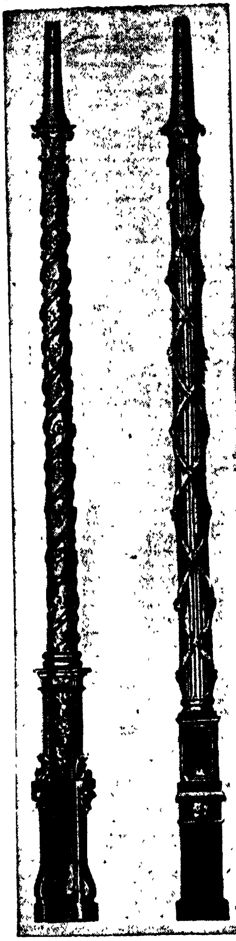
So, if you had been in London in 1750 and later, you would very likely have seen in some of the finest houses Thomas Chippendale's cabinets, bookcases, writing-desks, tables and clock-cases, and, of course, his chairs. For in chair-backs he made great changes and introduced a wide variety of decorative themes. Where they had been solid, or nearly solid, before, he made exquisite open-work carvings, giving the effect of tracery or interwoven strands—"the most elegant and pleasing thing" that had yet been done in furniture. A favorite design for his chair-backs was a looped-ribbon pattern. The legs of the chairs, too, were varied and made less thick and clumsy than before.



The corner of an Adam room.

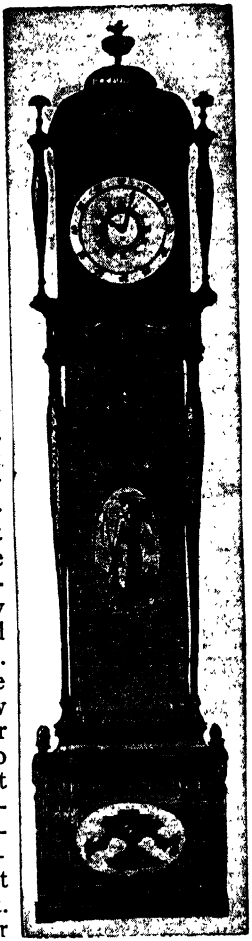
Not content with reaching only those homes which could be supplied from his own shop, Chippendale wrote a book, The Gentleman and Cabinet Maker's Director, which was widely studied and helped to increase his influence. It seems astonishing that one man, starting all obscure and unknown, should have been able to work so wide a change during a single lifetime. In addition to his artist impulse he must have had enormous courage and force. Suppose that some quiet, inconspicuous tailor to-day should try to give us entirely new fashions in clothes. Who would pay attention to him unless his designs were astonishingly pleasing?

The next stirring influence in house decoration came in the person of Robert Adam, born in Scotland about the time when the Chippendales were starting business in London. Educated at Edinburgh and in Italy, Robert became an architect, and in his profession shone only a little more brilliantly than his three brothers. All four probably learned from their father their first lessons in architecture, for he had already achieved success in this calling. About 1768 the Adam brothers planned and erected a splendid block of buildings in London between the Strand and the Thames, naming it the Adelphi, from a Greek word which means the "brothers." They built, besides, some of the handsomest houses in London and in other parts of the country. We have reason to feel especially grateful to them, for they were among the first architects to make fine large windows to let in plenty of light and air.


Chippendale bedposts.

Robert, during his three years of study in Italy, had become so enthusiastic over Roman and old Italian architecture and decoration that afterward a strong classic influence always touched his own work. But instead of copying the old designs he used them as models in creating a new manner of decoration, distinctively his own, with ovals and other curved lines as foundation forms. For you must know that this architect thought of a house as a whole, and wished to plan its interior adornment and its surroundings—not simply the shell of a dwelling-place. Even a dog-house was not too small a detail to be passed over. He and his brother James gave much attention to furnishings for the rooms they designed. Not only were doorways and mantelpieces a harmonious part of the wall-picture; but sideboards, mirrors, sofas and chairs were especially made to fit the scheme.

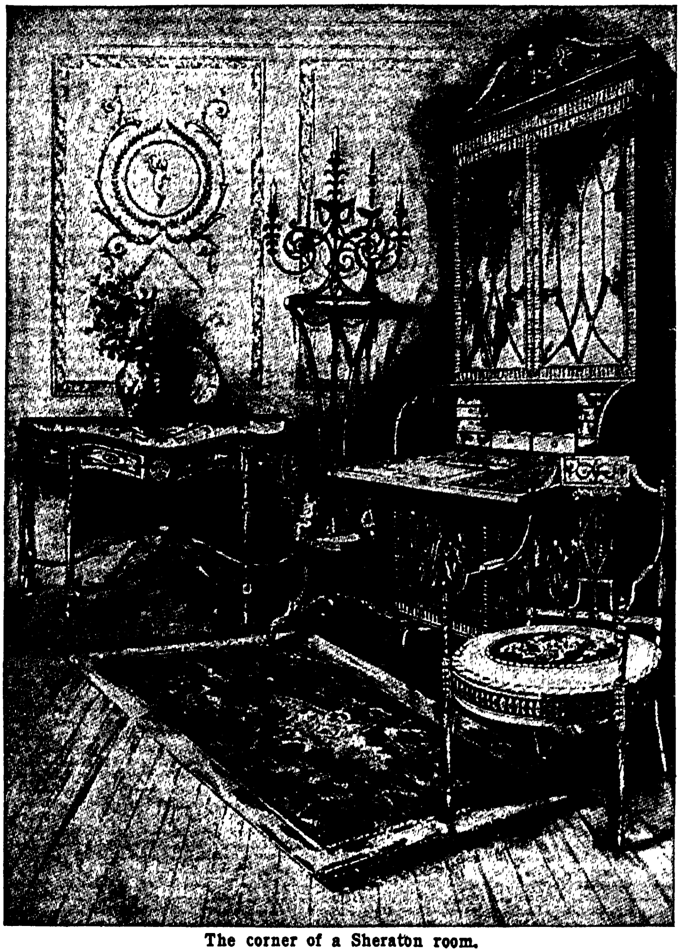
"Adam" furniture had less carving than had been used before. Instead, inlays of handsome woods were employed, or furniture was painted with attractive designs. On the whole the outlines were simple and the effect was delicate. For one thing, the elaborate curved legs that had been used for chairs and tables were given up for slender straight legs. Another change in construction made about this time—one which produced an effect of greater lightness—was the omission of stretchers, or underbracings, joining the legs of a chair near the foot.


A Sheraton clock.

The good work started by Chippendale and the Adam brothers spread fast, and a number of artists in furniture appeared. Among these, George Hepplewhite left a name which represents a style marked by light and delicate grace. Some of his products have even a fragile look, but they are really of sound construction. Legs, straight and tapering, were given a more slender appearance by the use of vertical lines of grooving. Chairs could be made smaller now than in earlier days, for hoop skirts had gone out of style; and upon planning beautiful chairs Hepplewhite spent much thought. Perhaps no other chair-back pleased him more than that with an open-work shield shape. He used it many times with pleasant variations. To this designer we owe much in the development of the sideboard—an article of furniture, which, like its cousin, the chest of drawers, was a descendant of the ancient carved chest. The chest, by the way, was the earliest form of furniture.

Now we come to "the most remarkable man in the history of English furniture."

Thomas Sheraton, born about 1751, was so many-sided in his ability that a sort of confusion of gifts was his undoing. First a writer on religious subjects and occasionally a preacher, he was artist, inventor and mechanic as well. Sometimes he gave drawing lessons to help make a living. Someone who visited him wrote that his house was "half shop, half dwelling-house, and himself looked like a worn-out Methodist minister, with threadbare black coat." His disposition was sharp, and he was likely to emphasize his own ability while speaking ungenerously of his rivals and his predecessors. Chippendale's designs he called "wholly antiquated and laid aside!" We, of course, do not agree with that opinion.

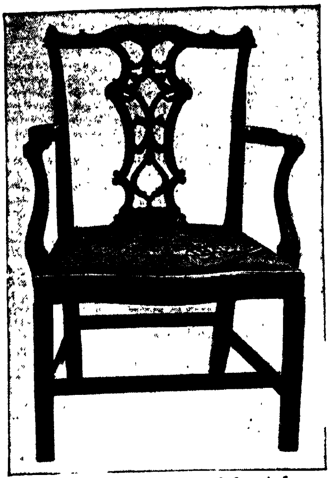

The corner of a Sheraton room.

This "great artistic genius living in chronic poverty" designed and made some of the most beautiful furniture ever produced outside of France—severely simple in line, exquisite in proportion and balance, delicate and lovely in decoration. Besides mahogany he used satinwood and other woods that had interesting grain and took a high polish. Carving in low relief was employed sparingly, but inlaid ornamentation was frequently a part of his plan and showed his rare skill and taste. Sideboards, bookcases, desks, sofas and chairs made after his models in his best style are most elegant and graceful. Yet the clever mind of Sheraton was sometimes betrayed into stupid yielding to fashion, especially in later years, when the French Empire styles were being wildly followed. Then, as heavier masses and crowded ornament came in, his designs presented a kind of zoo of sphinxes, lions and fabulous beasts in carving and metal mountings.

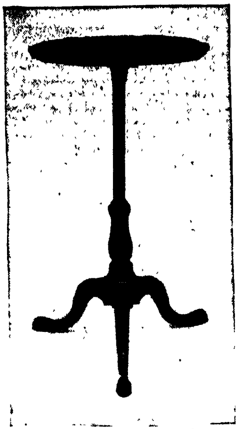
Sheraton could design and teach others better than he could actually make furniture himself; so he gave up furniture-making and wrote valuable books of practical instruction for furniture-makers. It is sad to think that at the time of his death, in 1806, he was in poverty, while to-day a good suite of his furniture sells for money enough to have kept him in plenty all his life.

We have already mentioned the devoted attention which the Adam Brothers, particularly Robert and James, gave to the adornment of the buildings they designed and how they strove to bring into harmony every form of decoration that goes

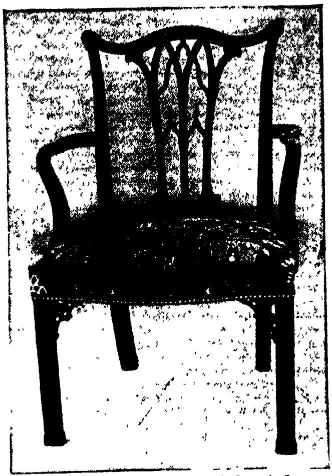
STYLES OF FOUR FAMOUS DESIGNERS



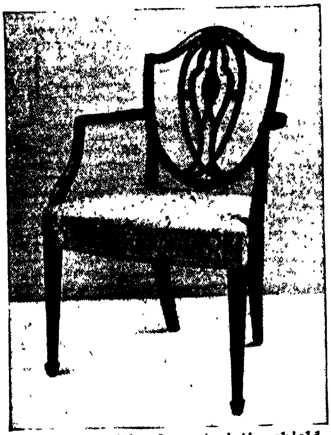
Armchair of Chippendale style, 1760–1770.



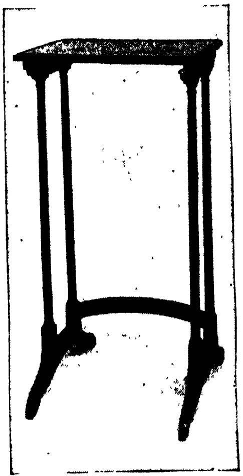
Tripod of the style of Chippendale.



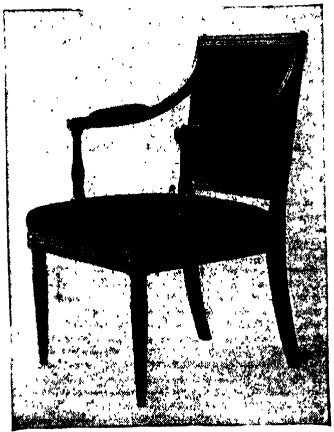
Armchair of Chippendale style, 1760.



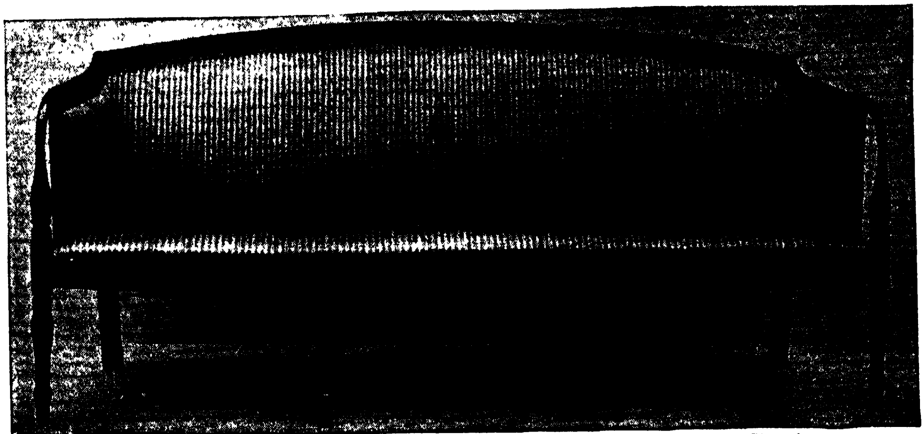
Armchair with characteristic shield-back design of Hepplewhite.



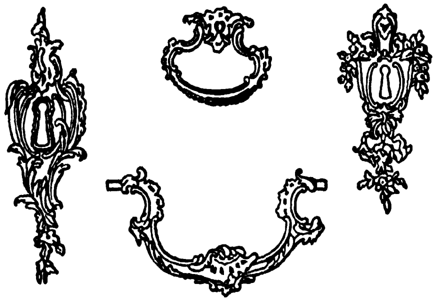
Table, one of a nest, style of the brothers Adam.



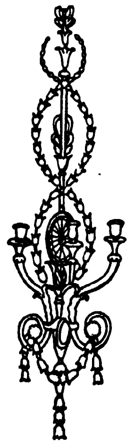
Upholstered armchair of the style of Sheraton.



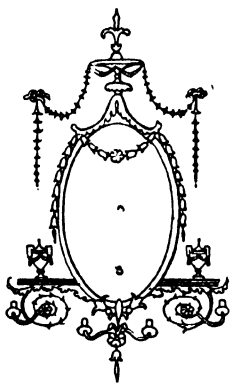
Sofa in the chaste and severely simple, but graceful and elegant, style of Sheraton.



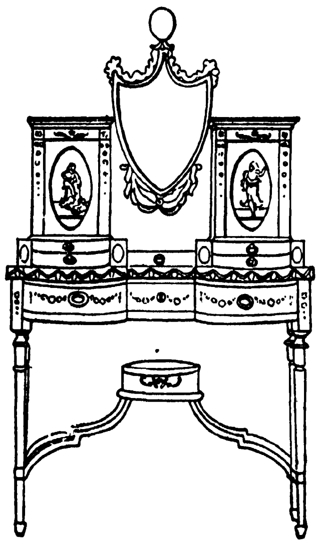
Brass keyholes and drawer pulls for Chippendale furniture.



Adam wall-bracket.



Hepplewhite mirror.



Sheraton satinwood dresser and mirror. The oval decorations were painted by the artist, Angelica Kauffmann.

Courtesy, Sherrill Whiton, "Interior Decoration"

into the making of a beautiful interior.

Although they created designs for many kinds of furnishings, they also called on able artists and craftsmen to help carry out their ideas. Chippendale is said to have made some furniture from Adam designs and Hepplewhite likewise.

Other artists, employed by them and by the architects of the period, though not widely known to-day, were Giovanni Battista Cipriani and Antonio Pietro Zucchi, who had come to England from Italy. Their paintings were often used as medallions on ceilings, wall panels, mantels and even on furniture. Better known, however, was the popular woman artist of that day, Angelica Kauffmann, who was the wife of Zucchi. Her paintings were much in demand for decorative work.

Another celebrated Italian artist brought to England for interior work was Michael Angelo Pergolesi, who excelled in designing ceilings and walls. He sometimes used a medallion painting as a central motif and worked out from that the whole ceiling and wall ornamentation.

The famous potter, Josiah Wedgewood, was called on to make urns and other pieces for use in these rooms, and he also made charming little plaques that were inset in the woodwork. Sheraton, in particular, loved to use the small plaques on the furniture he made.

But this period of good taste was to come to an end. Although the Napoleonic War had made bitter enemies of England and France, the English accepted a new style of French furniture, known as "Empire" from the empire which Napoleon had founded. In this furniture, cabinetmakers imitated Greek art, using cornucopias, scrolls, animal feet, wings, heads and the like, but exaggerated them so the effect was often ugly. A few years later, on the accession of Louis Philippe to the throne of France, there was an attempt to revive an interest in French furniture of the time of Louis XV, a style which touched the fancy of the English queen, Victoria. The furniture which developed in England from this inspiration is known as Victorian. As the nineteenth century moved on, it became clumsy and covered with ornamentation.

Our next article on furniture tells you about the styles that were copied in America and of the furniture that followed the Victorian period.

THE NEXT STORY OF THE FINE ARTS IS ON PAGE 6297.

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A minstrel singing one of his tales in a medieval castle.

THE LITERATURE OF GERMANY: I

IN the Middle Ages the people living in the territory that now makes up Germany proper spoke a number of different dialects; these were divided into two main groups, called High German and Low German. The High German dialects were spoken in the hilly midland and south; the Low German, in the low and level north. In the early days of German literature both groups of dialects were used for literary purposes.

The earliest written documents in German literature probably belong to the eighth century A.D. Before that time, however, there was a fairly abundant literature that was not written but handed down by word of mouth from one bard to another. (See Our Unwritten Literature, page 215.) This literature consisted for the most part of long pieces to be sung and recited. They were called lays. Most of them told about the old Teutonic gods and heroes.

The Lay of Hildebrand, which tells of the fight between Hildebrand and his son Hadubrand, gives us some idea of what the old poetry was like. Though this poem was set down in writing toward the end of the eighth century, it was undoubtedly composed several centuries before that time. The heroic lays on which the Song of the Nibelungs (see page 6266) is based also go back to the bards.

The old German texts that make up the written literature were mainly religious in character up to the twelfth century. Most of the writing in those days was done by men of the Church. They were not interested in preserving the old pagan myths and legends; they wished to tell the German people about the glories of the Christian religion. Hence these old texts deal with the miracles of Christ or with the lives of holy men and women; many of them consist of pious sermons. They are interesting as historical documents, but they have very little literary value.

A more imaginative kind of literature was born in the twelfth century. Men came to cherish the ideals of chivalry—of devotion to the knightly code of honor, of exalted love of womankind. The new spirit seems to have entered Germany from France. It resulted in a great new poetical development—the lyrics of the minnesingers (singers of love—*minne* means love in Old German). The names of some three hundred minnesingers have come down to us; there were undoubtedly many more. They wandered from court to court or from castle to castle singing their songs, which dealt not only with love but with knightly daring, faith and patriotism.

The most famous of all these poets was Walther von der Vogelweide, who flourished about the year 1200. Walther, a man of noble birth, composed and sang his songs at many a fair court. His travels took him from Hungary to France and from northern Italy to the Baltic Sea. His poetry is marked by a genuine lyric spirit and a sincere inspiration that is often quite lacking in his fellow minnesingers.

In the thirteenth century German poets perfected another type of poetry, the court epic, based in large part on the Old French romances (see page 6560). Among the finest of the court epics were Erec, Gregorius and Iwein, by Hartmann von der Aue, Tristan, by Gottfried of Strassburg, and Parzifal, by Wolfram von Eschenbach. These poems are not mere imitations of foreign works; they breathe a spirit of their own and they are sometimes superior to their models. This is particularly true in the case of Wolfram von Eschenbach's Parzifal, which tells the story of the Holy Grail with deep reverence and genuine poetical feeling.

The Song of the Nibelungs, the greatest German epic, was composed in the first years of the thirteenth century. The poem takes its name from the fact that Siegfried, its hero, had wrested a great treasure from the supernatural creatures known as Nibelungs. The Song of the Nibelungs tells how Siegfried wooed and won the fair Kriemhild; how he was treacherously slain; how he was avenged. The poem is really a combination of a number of heroic lays. The poet who put these shorter poems together has not always been able to make a smooth transition from one poem to another and there are some contradictions. Yet, in spite of these minor imperfections, the Song of the Nibelungs is a great poem. It breathes the very spirit of the heroic age of German legend.

The thirteenth century marks the highest point of development of German medieval literature.

In the fourteenth century a new spirit began to be felt. The Age of Knighthood, with its lofty but often impossible ideals, was dying. Men thought less about a dream-world and more about plain everyday living. The literature of the times shows very clearly this new outlook upon life.

In the fourteenth century the minnesingers gradually gave way to the mastersingers (*Meistersinger,* in German). These poets were originally good German burghers —tradesmen and artisans—who gathered together on long winter evenings to read poems and to try their own skill at verses. Soon these mastersingers, as they came to be

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A scene in the Song of the Nibelungs. Siegfried is murdered by Hagen while drinking from a spring.

called, founded a number of poetry societies. After a charter had been granted to them by the emperor Charles IV, in the fourteenth century, they formed a guild.

They met on certain days and at these meetings they criticized each other's verses. As a basis for the criticisms, the mastersingers made a list of the chief faults to be avoided; there were over thirty in all. The chief aim of these poets came to be, not originality, but correctness. Their poems were generally limited to songs of a religious nature; they also wrote so-called epics, which were simply rhymed versions of biblical narratives.

WAGNER'S OPERA, THE MASTERSINGERS, IS ABOUT THIS MUSIC GUILD

Besides meetings of the members of the guild, there were also public meetings. At these there was group singing in which the entire audience joined; then there was a poetical competition between members of the mastersingers' guild. Judges marked the faults in the various poems that were offered in competition. The poet whose song had the fewest faults received the prize, a chain with medals. Richard Wagner has given an interesting account of a meeting of this sort in the opera called The Mastersingers.

These odd poetical societies continued to exist until the eighteenth century. The mastersingers flourished particularly in the town of Nuremberg, where the most renowned mastersinger of all, Hans Sachs, wrote his verses.

THE BEAUTIFUL, SIMPLE FOLK SONGS SURPASSED THE FORMAL VERSES

The showy and rather dull poems of the mastersingers were composed in great numbers throughout the last two centuries of the Middle Ages. They were surpassed, however, by the *Volkslieder* or folk songs, in which the very soul of the German people was expressed. These simple poems deal with all sorts of subjects—love, war, wine, spring, winter. There are stirring ballads, merry drinking songs and sober hymns. All these poems are marked by sweet simplicity and great naturalness.

The burghers of the fourteenth and fifteenth centuries had little use for the courtly epics of the thirteenth, with their aristocratic notions of chivalry. The old romantic stories did not entirely disappear, however. They were rewritten in prose and enjoyed a certain popularity. German drama, like that of most other peoples, was religious in origin. It was developed from the simple religious playlets given by the Church at Easter, Christmas and other religious festivals. These Church plays developed in the later Middle Ages into great spectacles; they continued to be written and produced for hundreds of years. A great number of these religious plays have been preserved—Passion Plays (dealing with the passion or sufferings of Christ—*passio* means suffering in Latin), Easter plays and Christmas plays. The great Passion Play first produced at Oberammergau in 1663 has been given almost uninterruptedly up to our own times, every ten years; the last performance took place in 1930.

In the sixteenth century German literature felt the full force of the religious reform movement which was begun by Martin Luther (1483-1546) and which resulted in the foundation of the various Protestant sects. Religion occupied the minds of men throughout the century. They studied religious problems with renewed zeal; they engaged in bitter religious quarrels.

MARTIN LUTHER TRANSLATED THE BIBLE INTO A HIGH GERMAN DIALECT

As for Luther himself, his place in German literature and in the formation of the German literary language is very important. Although he wrote a number of fine hymns, his chief contribution to German literature was his remarkable translation of the Bible into German—a work that ranks as a German classic. Luther used for this translation the official language of the Saxon electorate. (A German prince entitled to take part in choosing a German emperor was called an elector; his territory was known as an electorate.) This official Saxon language was a form of High German, though the everyday speech of the people of Saxony was a Low German dialect. The great prominence attained by Luther caused the High German dialect in which he wrote to crowd out in time all the other German dialects. High German became the standard literary language.

EDUCATED GERMANS TO-DAY SPEAK HIGH GERMAN

The dialects have not disappeared; a number of them, both High German and Low German, are used in the speech of the people in various parts of Germany. However, educated Germans to-day in all parts of Germany, generally speaking, use one and the same language—the standard literary tongue—except when they use dialect to produce certain effects.

As Protestantism began to spread over

large areas of Germany, Protestants and Catholics alike used literature as a weapon of religious strife. Thomas Murner (1475-1537?) was the chief spokesman for the Catholics, while Johann Fischart (1550?-1591?) represented the Protestant point of view. This sort of literature has no great interest for most modern readers. It often centres about men and problems little known at the present time.

Perhaps the finest religious works of the sixteenth century are the writings of the mystics, both Catholic and Protestant, who tried to detach the minds of men from worldly things and to lead them to the joys of the spirit. The greatest mystic of all was Jacob Boehme (1575-1624), who was a master shoemaker by trade. Although some of the ideas set forth in his Aurora and other works seem rather strange in this modern age, Boehme succeeded in expressing beautifully man's longing for the divine and his supreme joy when this longing is satisfied.

Hans Sachs, the Nuremberg shoemaker and poet.

In the sixteenth century, as we have seen, the mastersingers at last produced a great poet, Hans Sachs (1494-1576). Like Boehme, Sachs was a shoemaker and from 1510 to 1515 he traveled over various regions of Germany working at his trade. In 1515, he established himself at Nuremberg and here he devoted himself with equal industry to his shoes and his verses. Sachs looked at the world with the wondering eyes of a child; he turned what he saw into a charming story or a joyous poem or a serious religious play. He spoke familiarly of even sacred things; yet this simple-hearted shoemaker was a truly religious man.

The Renaissance movement in Europe, begun earlier, found enthusiastic followers in Germany in the sixteenth century. However, the greatest German Renaissance writers of the time, such as Melancthon and Hutten, wrote their most important works in Latin and were not particularly interested in their native literature. A number of inferior writers also tried to introduce the new ideas in their works, but they produced little that was worth while.

In the first half of the seventeenth century, the terrible Thirty Years War (1618-48) made Germany a vast battlefield. The war had a disastrous effect upon the world of letters; the seventeenth century was one of the poorest periods in German literature. There were, however, a few outstanding figures in the century.

Martin Opitz (1597-1639) set out to reform German literature by applying the ideas of the Renaissance. In his Book of German Poetry (1624), Opitz broke entirely with the literature of the past and set up a series of literary rules based on imitation of the old Greek and Latin writers. To teach his theories, Opitz founded a literary group known as the Silesian School (Opitz was a native of the district of Silesia). The poetry of the School was marked by good taste and very little poetical inspiration. The next generation saw the formation of a Second Silesian School, which imitated not only the classics but also the extravagant works of contemporary Spanish and Italian writers. The results were often most ridiculous.

PAUL GERHARDT, HYMN-WRITER IN THE SAD DAYS OF THE THIRTY YEARS WAR

A more truly poetical note was struck by the pious hymn-writer Paul Gerhardt (1607-76). He never lost his belief in the goodness of God and of the world that God created. The dark days of the Thirty Years War only caused him to exclaim that "misfortune is my joy and night my sunshine." To him all creation seemed to set up a mighty chorus of thanksgiving, in which the poet was glad to join.

There was one first-rate novel in the seventeenth century—The Adventurous Simplicissimus, by Hans Jakob von Grimmelshausen (1625-76). The story tells of a certain Simplicissimus, who has all sorts of adventures in the days of the Thirty Years

War. Simplicissimus often yields to temptation; in the end, however, he repents and becomes a hermit. Grimmelshausen gives us a gloomy picture of the times. Yet all is not shadow in this remarkable novel; there are passages of sharp wit and good humor.

German literature was at a low ebb by the end of the seventeenth century. German writers in the course of the century had imitated Greek, Latin, Spanish and Italian authors with poor results. They now turned to the imitation of French literature, which had produced a series of masterpieces in the seventeenth century (see page 6711). "French literature has produced great works; so can German writers, by applying the literary rules followed by the French." Such was the argument of the dull Johann Christoph Gottsched (1700-66) in his Essay on a Critical Poetic Art. Gottsched meant to purify German literature; he only succeeded in tying it down by means of rules that made no allowance for inspiration.

The Swiss literary critics Johann Jakob Breitinger (1701-76) and Johann Jakob Bodmer (1698-1783) assailed Gottsched's doctrines. They thought that poets should follow their own inspiration, not a set of fixed rules. They denounced the use of French models; they thought that Germans would do well to go back to their own literary past—to the noble old Song of the Nibelungs and the courtly minnesongs. Breitinger and Bodmer had a certain following yet, in general, German men of letters in the first half of the eighteenth century meekly accepted Gottsched's ideas.

THE REBIRTH OF GERMAN LITERATURE IN THE REIGN OF FREDERICK THE GREAT

It was not till the reign of King Frederick II of Prussia that German literature had a rebirth. He ruled from 1740 to 1786, and is commonly known as Frederick the Great. Frederick himself contributed not a little to this result. To be sure, he had nothing but scorn for German writers. He was a great admirer of French literature and he preferred to write in French, a language in which he became a master. His great military victories, however, had a heartening effect on Prussians, and indeed all Germans, and gave them a renewed national pride. Furthermore, although he was an absolute monarch, Frederick granted his subjects entire freedom of religious belief and philosophical thought. Other German princes of the time followed Frederick's example. It was the sort of atmosphere in which literary men could develop the best of their genius.

The first outstanding writer of the period was the poet Friedrich Gottlieb Klopstock (1724-1803). Inspired by Milton's Paradise Lost, Klopstock set out to write a great German epic about the sufferings of Christ and the salvation of mankind. The first three cantos of this epic, which was called The Messiah, were published in 1748 and aroused the greatest enthusiasm in Germany. Klopstock cared for no literary rules; he wrote as he pleased and gave his imagination free sway. Men impatiently awaited the rest of The Messiah. They had to wait a long time; the twenty cantos of the poem were not completed until 1773. Though The Messiah has passages of rare beauty, modern readers find its background and its action vague. Klopstock's Odes surpass the Messiah in literary merit. Klopstock thought of himself as a man directly inspired by God —as a leader and prophet with a message for all mankind.

Christoph Martin Wieland (1733-1813), on the other hand, scoffed at mystery; he exalted reason. He believed in freedom of thought and freedom of expression. Wieland wrote several fine novels—Agathon and The Abderites—and the charming fairy epic of Oberon.

THE PLAYS AND CRITICAL WORKS OF GOTTHOLD EPHRAIM LESSING

The good and wise Gotthold Ephraim Lessing (1729-81) was a greater man than either Klopstock or Wieland. He became very much interested in the drama as a youth and he retained this interest, as critic and author, till the end of his life. His plays broke definitely with the French dramatic rules which had been applied by most of his predecessors. His finest plays are Minna von Barnhelm, a fascinating study of contemporary German society, and Nathan the Wise, in which he makes an eloquent plea for religious tolerance.

Lessing was as great a critic as he was a dramatist. His Hamburg Dramaturgy urged the establishment of a national German theatre. His Laocoön was a remarkable analysis of the differences among painting, sculpture and poetry. In this work Lessing showed himself a great admirer of Greek antiquity, which he thought had much to teach German writers. He thought, however, that moderns should not try to imitate the Greeks but rather to absorb their spirit. Lessing contributed greatly to German literature as author and critic. He was, be-

Goethe, one of the greatest writers of all time.

sides, the leading apostle of liberalism of his day—a liberalism that stood for intellectual freedom, religious tolerance and social reform.

Klopstock, Wieland and Lessing represent the older generation of the writers who flourished in the reign of Frederick the Great. With the next generation of writers, toward the end of the seventies, there is born the storm and stress movement (Storm and Stress is the name of a play by Klinger, one of the playwrights of the day). This movement, which owes much to the teachings of Jean-Jacques Rousseau (see page 6715), represents a war against established authority. It urges men to be "natural"; that is, to give themselves up freely to their emotions. The storm and stress men were revolutionaries in literature; they were generally revolutionaries in politics.

The theologian and critic Johann Gottfried von Herder (1744-1803) was one of the pioneers of the storm and stress movement. Herder began his literary career as a devoted follower of Rousseau; he stood for literary freedom and the rights of the individual. In later life the individual became less important to him than the nation of which the individual is a part. Herder's ideas are to be found in such works of his as Critical Woods, and Fragments on German Literature.

The outstanding figures in the storm and stress movement were Goethe and Schiller. Both of these men outgrew their early radicalism and produced a series of mature masterpieces that have never been surpassed in German literature.

GOETHE, WHOSE MIND AND SOUL GAINED TOLERANCE AS HE GREW OLDER

Johann Wolfgang von Goethe (1749-1832), born of well-to-do and cultured parents, was caught up in the storm and stress movement in early manhood. This spoiled youth, who had enjoyed the benefits of civilization, brought the wildest charges against it in the revolutionary play Götz von Berlichingen and in the woeful novel called The Sorrows of Werther. These works seem violently exaggerated to us to-day. They seemed no less so to Goethe as the years brought a calmer spirit. The rebel of the storm and stress days became the deep thinker, who humbled himself before the greatness of the universe. Man, he thought, must make himself worthy of the universe in which he lives by striving endlessly to better himself.

This is the central teaching of Goethe's immortal drama Faust. Faust, a restless old philosopher, has made a deep study of many arts and sciences, but has not found happiness in any of them. He strikes a bargain with the devil. He will yield up his soul if the devil will so satisfy Faust that he will ask for nothing more. The devil restores Faust's youth and gives him everything he desires—charm, power, great wealth. Yet Faust finds that the enjoyment of the moment can give him only a fleeting pleasure that cannot endure; never is he truly satisfied. Therefore, in spite of his sins, Faust saves his soul because he has always continued to search for something better than the present can offer. Faust is Goethe's greatest drama; he wrote others which rank high in German literature—Egmont, Iphigenia in Tauris and Torquato Tasso.

Goethe's great novel, Wilhelm Meister, is a magnificent study of the growth of a human mind. The hero, Wilhelm Meister, is a humble burgher, who searches eagerly after knowledge. In the course of his endless wanderings he acquires a deep and tolerant culture that makes the great men of his day eager for his company. Like Faust, Wilhelm always seeks something nobler and better than the present moment has to offer and for that reason he finds happiness in the autumn of his life.

As a lyric poet Goethe has no equal in German literature. He combines with great descriptive power and mastery of versifica-

The Bettman Archive

The story of Goethe's tragedy, Faust, is based upon an old legend. The tired and aging philosopher, Faust, sells his soul to the devil, in return for renewed youth and pleasure. He later repents his bargain.

tion the ability to suggest a wide variety of entirely different moods. The charming simplicity of There Was a King in Thule and The Wild Rose contrasts strongly with the rich Oriental background of the verses in his Western-eastern Divan. The most beloved of his poems is the long idyll Hermann and Dorothea, which tells of the love of an innkeeper's son for a poor refugee girl. This is generally considered to be one of the greatest poems in the German language.

Goethe also wrote a number of scientific and philosophical works as well as a charming autobiographical study, Poetry and Truth, which gives us a detailed account of his romantic youth.

An undying friendship united Goethe with Johann Christoph Friedrich von Schiller (1759-1805). Like Goethe, Schiller was a strong supporter of the storm and stress movement in his youth, and his writings were marked by a spirit of revolt. The hero of his first drama, The Robbers, is a noble youth who has been unjustly treated by men. He takes to the woods, gathers a band of robbers about him and, uttering grand phrases, makes war on human society. The other dramas Schiller wrote in this period are also violent and full of exaggeration.

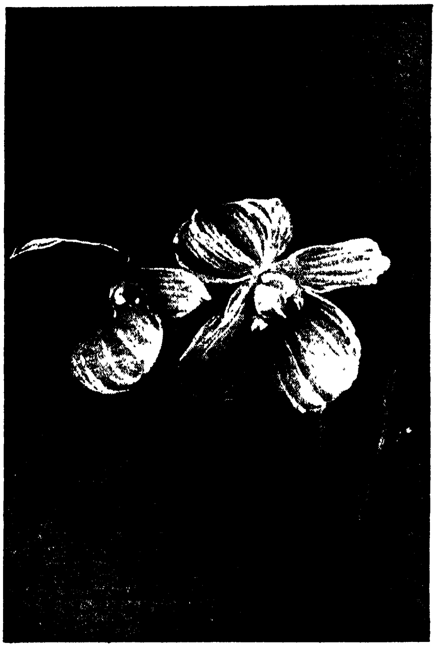
Schiller soon outgrew these youthful excesses. He turned to the study of history and wrote several very interesting if not entirely accurate works—The Secession of the Netherlands and The History of the Thirty Years War. In 1794 there began the famous friendship with Goethe; the two men became close literary allies.

Schiller now wrote a series of masterpieces. The poems called ballads and romances rank with the most popular of his works; they include The Diver, The Glove and The Cranes of Ibycus. In this period, too, he composed the thoughtful poems, such as The Song of the Bell and Ideal and Life, which set forth his philosophy. Like Goethe, Schiller holds that man should set up lofty ideals and then do his best to attain them.

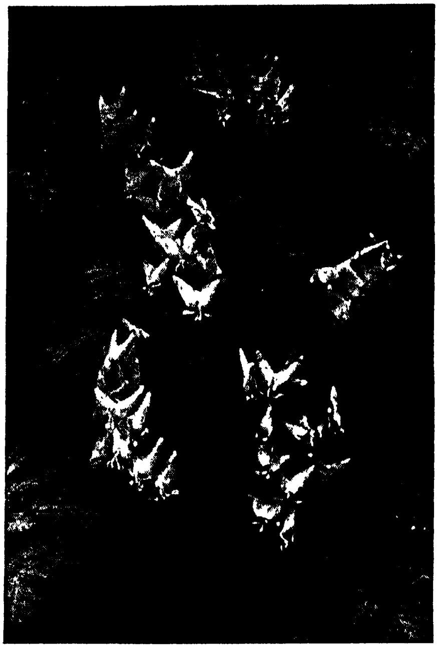
The greatest works of Schiller are his poetic dramas—Wallenstein, Mary Stuart, The Maid of Orleans, The Bride of Messina and William Tell. The last-named is perhaps the most popular of all his poetic works. Though the great Swiss hero William Tell appears to be the central character, the real hero of the play is not William Tell but the Swiss people, who stand ready to sacrifice all for freedom. In his storm and stress dramas, freedom had meant for Schiller the freedom of the individual to do anything he wanted. In William Tell he thinks of freedom as the right of a people to develop their national feeling and their national culture unhampered by a foreign conqueror.

THE NEXT STORY OF LITERATURE IS ON PAGE 6409.

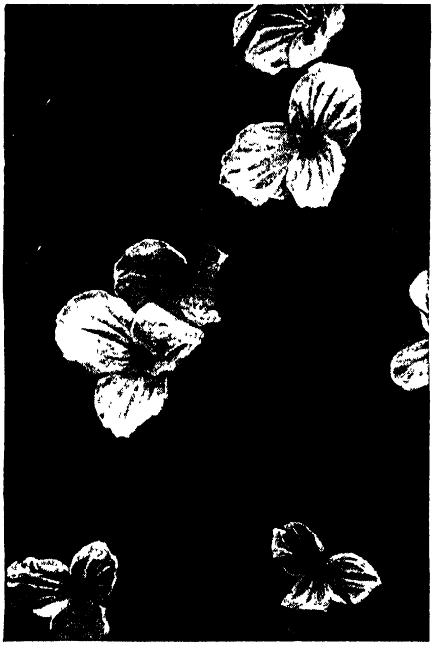
ATTRACTIVE NORTHERN FLOWERS



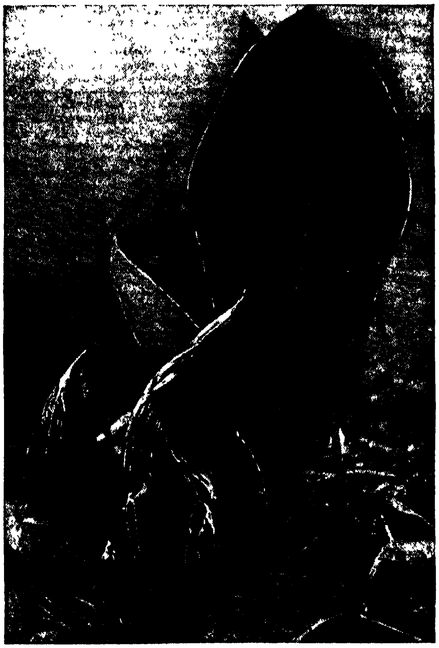
The showy cypripedium is by many thought to be the most beautiful of the lady's slippers. Its large, white flowers usually bloom in June and July. This flower belongs to the orchid family.



Dutchman's breeches is an April flower. Its lovely heart-shaped white and yellow flowers spring from clefts in rocky cliffs. It has thrice-compound leaves. Its tuneful Latin name is bicuculla cucullaria.



The large white trillium shown in this picture is the most beautiful of the trillium family. It fills the northern woods with its starry white blossoms in May. Farther south the blossoms come earlier.



The flowers of the skunk cabbage make their appearance before the green leaves. They are hidden by a purplish spathe that curls round them. The plant has an unpleasant odor, whence the name.

FLOWERS OF NORTH AMERICA

FLOWERS OF THE EAST: PART I

YOU have been told that the same flowers do not grow in every part of even a small country. Because of differences in the amount of heat and moisture, in height above the sea, and in the kind of soil, flowers which are common in one place may be rare or unknown a hundred miles away. In a continent like North America with great differences in climate and altitude there are many zones each of which has different kinds of plants. On the other hand, some plants are able to live in several zones. For example, you will find many eastern plants in the South. We shall divide North America into four regions, the East, the South, the Middle West and the Pacific, and study the flowers of each region.

Over four thousand flowering plants have been found in the East. Of these only the most common ones will be described. Fortunately plants occur in families and show striking family characteristics. This helps us in our desire to study them.

In the spring the trees are the first to present their flowers. Long before the snow has disappeared, the "pussies" on the Willows have burst their purplish brown winter jackets and presented their velvety gray catkins, which form a charming contrast to the reddish twigs. Some gray catkins become yellow; these bear the pollen which is carried to the silvery green pistillate catkins by wind and insects. The pistillate catkins remain, after the leaves of the tree have unfolded, and ripen their seeds which are carried away by wind. The Poplars belong to the Willow Family, and, like the willows, send out gray, downy tassels before the leaves open. Birches also bear catkins, which appear in the early spring. Birch catkins are long and graceful, of a silky softness, and with a rich golden color.

Most Maples blossom early. Even in April the Red Maple is covered with tiny red blossoms. These, with the red twigs, give the tree a striking appearance, in contrast with the white snow which may not have disappeared. The Silver Maple has yellow flowers, and the Rock, or Sugar, Maple, the national tree of Canada, sends out greenish yellow flowers on slender hairy stalks, in graceful, drooping clusters appearing a short time after the leaves have unfolded. The Basswood, or American Linden, blossoms in May. Its fragrant honey-bearing flowers appear in clusters hanging from the centre of a narrow leaf-like bract. This bract later serves as a float to the fruit.

The beautiful, stately Elm is a popular tree in the East. It grows to great height, with drooping branches, and in general shape is like an inverted cone. For lining streets, and to lend grace to any landscape, it is one of the most charming of our trees. Before the leaves have opened, the flowers, on slender, drooping stalks, fringe the sides of every branch. The fruit is one-seeded and is surrounded by a thin wing, which serves as a float. The fruits drop early, and in June can be gathered in great quantities.

SOME OTHER FLOWERS OF THE FOREST

The Oaks, Beeches and Chestnuts also blossom early. The Horse-chestnut, though not so common in our woods as oaks and beeches, has beautiful flowers, which appear during the latter part of May. In winter each twig ends in a bud one inch or more long, and within the scales of this bud are borne the leaves and flowers of the coming year. When the warmer days of spring come the resinous scales of the bud drop off, and the leaves—tiny downy green babies done up in woolly blankets—appear.

The Gray Hoss-Chestnut's leetle hands unfold,
Softer'n a baby's be, at three days old.

The white flowers are very attractive, and appear in large erect clusters resembling the flower-cluster of the common lilac. The native broad-leaved trees of America are beautiful in midsummer, and sometimes we think particularly so in their autumn tints of yellow and red, but the charm in early spring is great when

The saffern swarms swing off from all the willows,
So plumb they look like yaller caterpillars.

THE FIRST FLOWERS OF THE EARLY SPRINGTIME

If one is bold enough to venture into swampy places in the leafless woods in March, he may find the purple-mottled, sharply pointed spathes of the Skunk Cabbage. The young buds pushed their way upward before the winter set in, and Thoreau advises those afflicted with melancholy to go to the swamps and see the brave spears of skunk cabbage already advanced toward a new year. The purplish shell-like leaf that curls about the tiny flowers, which are hidden from view, is not attractive, and the whole plant, as its name implies, possesses an unpleasant odor, so that while we admire its bravery, we shall not be inclined to gather it. The large beet-shaped leaves, which grow to a length of from one to two feet, appear later than the spathe and flowers, and help to mark the wet woods with bright patches of rich foliage. It has been said that bears greatly relish this early green, and settlers near Philadelphia gave to the plant the name Bearweed. One writer remarks that "it must have been a hot morsel, as the juice is acrid, and is said to possess some narcotic power, while that of the root, when chewed, causes the eyesight to grow dim."

THE SWEET-SCENTED TRAILING ARBUTUS, OR MAYFLOWER

Though quite unlike the skunk cabbage in every respect, the Sweet-scented rosy-lipped Mayflower, or Trailing Arbutus, appears in April or early May locally among damp and withered leaves, in sheltered hollows, under trees or in little dells. It has been described as

Pink, small and punctual,
Aromatic, low.

The stem has rusty hairs, and is prostrate or trailing. The leaves are rounded, heart-shaped at the base, and evergreen. The fragrant pink waxy flowers are hidden in little clusters beneath the leaves. Because of their delicious fragrance and rich store of honey the flowers are much sought after by both man and bees. There is the pretty story that the Mayflower was the first flower to greet the Pilgrims at Plymouth after their fearful winter, and give them a promise of better days to come. Whittier says:

Yet God be praised! the Pilgrim said
Who saw the blossoms peer
Above the brown leaves, dry and dead,
Behold our Mayflower here!

OTHER FLOWERS THAT GLADDEN THE EARLY SPRING DAYS

Coltsfoot is found in April. It is an immigrant from Europe, but is now wild in this country. It has a slender scaly scape from three to eighteen inches high, which bears a solitary yellow flower-head that somewhat resembles a dandelion. It has both ray and disk flowers. The leaves appear later than the flowers, are heart-shaped below, lobed and woolly beneath. It is found growing in most ditches and along the banks or in the beds of streams, where the bees seek it out for the honey from its flowers.

Soon after the late snow has melted
The Liver-leaf puts forth her sister blooms
Of faintest blue—

In the woods in early May we may find the fragile-looking, emerald-like flowers of Liver-leaf, more commonly called Hepatica. The flowers are white, pink or blue, and less than one inch broad. Each flower is borne on a fuzzy scape. The leaves are rounded and three-lobed, and the rusty brown leaves of the previous summer remain over winter, and afford a pleasing background for the delicate flowers.

In April or May we look for the Spring Beauty, which, like hepatica, opens in the sun and closes in the shade.

> So bashful when I spied her,
> So pretty, so ashamed!
> So hidden in her leaflets
> Lest anybody find.

Though not much "hidden in her leaflets," the flowers of spring beauty, which is also called Claytonia, are very pretty. They are white with pink veins, or pink with deeper colored veins, and grow in a loose cluster. Deep down beneath the ground is a small round swollen stem, or tuber, which in early spring develops into a long slender aerial stem bearing two grass-like leaves opposite to each other. At the top is the loose cluster of flowers. It is found in moist open woods in many parts of Canada and the United States.

BLOODROOT, WHICH THE INDIANS USED TO PAINT THEIR FACES

In April the curled-up leaf of Bloodroot, wrapped in papery bracts, pushes its firm tip through the brown leaves, and soon presents a white or rose-tinted flower borne on a naked scape. The foliage leaves are round and deeply lobed. The flowers are beautiful, but the snowy petals quickly fall from about their golden centre, and in two or three days the loveliness of the flower is gone. The plant receives its name because of the crimson juice of its rootstock. The red liquid which oozes from the wounded stem when the flower is picked stains the fingers. The crimson juice was much prized by the Indians for use in decorating their faces and tomahawks, and in some places it was called Red Indian Paint. The plant grows in eastern Canada and the United States. It is a member of the Poppy Family.

Dutchman's Breeches has thrice-compound leaves, and white and yellow flowers growing in a raceme on a slender scape. Each flower is heart-shaped, with two bracts or small leaves near its base, two scape-like sepals, four somewhat cohering white petals tipped with yellow and six stamens in two groups. The two outer petals are large, with spreading tips and deep spurs; the two inner are small, with spoon-shaped tips uniting over the anthers and stigma. The underground stem consists of little grain-like tubers collected into one mass, which resembles a bulb.

THE PRETTY YELLOW SQUIRREL CORN

Squirrel Corn very much resembles Dutchman's breeches. Its underground stems bear scattered yellow tubers resembling grains of corn. Its graceful clusters of nodding flowers have the fragrance of hyacinths. Both are found in rich woods.

In April the seams of rocky cliffs and hillsides begin to whiten with the blossoms of Early Saxifrage. The leaves are clustered at the root. On a scape from four to nine inches high are borne the small white flowers in clusters. The calyx is five-cleft, and the corolla has five petals, and there are ten stamens. When ripe, the seed-pods have a rich madder-brown tone, which gives a warm color to the rocky slopes on which the plants grow.

Our seasons vary from year to year, but usually the same flowers are found in blossom at the same time. When you find the liverwort, you may look for the bloodroot and the adder's tongue, the trillium, and soon the spring beauty, the anemones and the violets. In many places the blue violets cover the ground with a sheet of dainty violet tinge.

A BEAUTIFUL FLOWER WITH TWO UGLY NAMES

The Yellow Adder's Tongue, a member of the Lily Family, though often called the Dog's-tooth Violet, sends up a one-flowered scape from six to nine inches high. Surrounding the scape at its base are two oblong lance-shaped leaves, which are pale green, mottled with purple and white. The nodding flower, with a perianth of six pale yellow parts marked with purple, resembles a small lily. The two names which the plant bears are inappropriate. Mr. Burroughs has suggested "Fawn Lily" or "Trout Lily"—the first name because the two mottled leaves stand up with the erect, startled look of a fawn's ears; the second because of its speckled foliage, and because it appears when the fever for trout-fishing seizes many people. It grows in those hollows in the woods where the early May sunlight filters through the still, leafless branches of the budding trees.

THE WIND-FLOWERS OF THE MAY TIME

Bryant writes:

> . . . Within the woods,
> Whose young and half transparent leaves scarce cast
> A shade, gay circles of anemones
> Danced on their stalks.

And Whittier tells how these

> . . . wind-flowers sway
> Against the throbbing heart of May.

The Wood Anemone, or Wind-flower, has a simple slender stem, three petioled leaves, each with three wedge-shaped leaflets, and a solitary white, pink or purplish flower of from four to seven petal-like sepals. Our wind-flower seems to us an emblem of spring and purity; but to the ancient Persians it was an emblem of sickness, because it was believed that the wind which had passed over a field of anemones was poisoned, and that disease followed in its wake. The Rue Anemone has leaves with rounded leaflets and white or pinkish clustered flowers. The two anemones blossom at the same time, but the rue anemone lingers after the wood anemone has finished blooming.

THE GAY TRILLIUMS WHICH ADORN THE WOODS

The Trilliums are among the most attractive May flowers. There are three common ones, the white, the purple and the painted. The large White Trillium, or Wake-robin, is without a rival in purity and abundance. It fills rich woods in Eastern America, and lends a distinctive charm to the landscape, as its great white stars stand out from shaded wood borders or from the banks of swift-flowing streams. From a stout rootstock arises a stem bearing a whorl of three green leaves. The flower is terminal, and has a calyx of three green sepals, a corolla of three long pointed white petals, six stamens, and a pistil of three stigmas. The ripened fruit is a dark purple berry, ovate and somewhat angled. The flower is beautiful, but without perfume or nectar. Unhappily these beautiful flowers have almost been exterminated in some sections of the country, particularly near large towns. Careless hands pull up the plants, without a thought of seed or root for the flowers of coming years.

The Painted Trillium is not so large and showy. Its three white petals are painted at their base with red stripes. The so-called Purple Trillium has a stout stem, with a whorl of three broadly ovate leaves a short distance below the solitary terminal flower. The calyx consists of three green spreading sepals, and the corolla of three large lance-shaped pinkish petals. It is a hardy harbinger of spring, but the name Wake-robin, which it bears, is not appropriate, because the robins have usually been about and on the alert several days before our flower unfurls its crimson signal.

VIOLETS—BLUE, PURPLE, WHITE AND YELLOW

Among the most popular of all spring flowers are the Violets, in yellow, white and blue. Over forty species have been observed in America, and they are found flooding the swamps, fringing the hills, and lurking in shady nooks on the hillside, from the Atlantic to the Pacific. The common Blue Violet, with its slender one-flowered scape, its heart-shaped leaves, and its pale blue to deep purple flower, is perhaps the best known and the most beloved of all. The five petals of the corolla are somewhat irregular, and the lower one is spurred at the base.

> . . . purple violets lurk,
> With all the lovely children of the shade.

There are many species of blue violets. An interesting feature in connection with violets is that many of them have hidden flowers, where self-fertilization takes place, and the seeds are ripened in the dark near or beneath the ground. One species is called the Canada Violet. It has white petals veined with purple and violet beneath. Its delicate flowers are fragrant, and it is among the loveliest of the family. The Sweet White Violet, the most fragrant of the violets, has small white flowers daintily veined with brownish purple, and is found in low wet woods. The Downy Yellow Violet has an erect leafy stem, broadly heart-shaped toothed leaves, and yellow flowers veined with purple.

> The yellow violet's modest bell
> Peeps from the last year's leaves below.

In late April and early May our wet meadows are brightened by the golden yellow flowers of the Marsh Marigold.

SPRING FLOWERS OF NORTHERN WOODS

The Hepatica is one of the best known of our spring flowers, and one of those that the children love best. It blooms in our northern woods in early May.

The Adder's Tongue, which also blooms in early May, is a member of the Lily Family. Its tall, lily-like flower is pale yellow marked with purple.

The Bloodroot gets its name from the crimson juice of its rootstock. It is also called Indian Paint, because the Indians used the root juice to paint their faces. The flowers are white or rose-tinted.

The Bellwort is another member of the Lily Family. The leaves of the plant clasp its graceful, curving stem, and under them hang the pale yellow drooping flowers. It is abundant in the spring woods.

This name was given it because the early English settlers in America thought it identical with Shakespeare's Mary-buds.

> And winking Mary-buds begin
> To ope their golden eyes.

Others, dreaming of home, called it Cowslip, and that name still clings to it. The leaves are rounded and somewhat kidney-shaped, with several growing from the base of the stem, which is furrowed and hollow, and bears above several flowers which have no corolla. The flower is made up of from five to nine golden yellow petal-like sepals, with numerous stamens, and from five to ten pistils, which ripen into little seed-pods. The flower produces much pollen and an abundance of honey, and is therefore much visited by bees. It is common in Canada and the United States, and is so abundant along certain English rivers as to cause the ground to look as though paved with gold.

TWO FLOWERS THAT HAVE BITTER ROOTS

Another dweller in marshy land is Jack-in-the-pulpit, or Indian Turnip. There are generally two leaves on long leaf-stalks, and each is divided into three leaflets. Terminating a scape is a hood-like leaf, or spathe—the pulpit—which is light green, veined with a deeper tint and stained with purple. Inside the spathe are the small, inconspicuous flowers packed about the lower part of a fleshy spike. The flowers are without calyx or corolla, and are of two kinds: the one composed of several united anthers, the other of a single pistil with a bush-like stigma. The two kinds of flowers may be on the same spadix or on different ones. If on the same spadix, the pistillate flowers are at the base and ripen into bright scarlet berries packed upon the spadix. The Indians boiled these scarlet berries and ate them with great relish. Later they discovered that the fleshy bulb-like base of the stem, called a corm, in which is stored the food for next year, lost its stinging taste when cooked, and made nutritious food—hence the name Indian Turnip. It is a favorite schoolboy trick to tempt others to bite into the raw, blistering corm. The impression made on the tongue is not soon removed, and the second bite is not often taken. It is a cousin of the skunk cabbage and sweet flag, and the taro root of the Pacific Islands also belongs to the same family.

The underground stem (rootstock) of Wild Ginger, which sends up its shy, dull purplish brown solitary flowers in May, has a ginger-like flavor, and by the early settlers was considered a remedy for headache and deafness. It sends up one or two kidney- or heart-shaped fuzzy leaves on long stalks, and the tiny flower lies close to the ground on a short stem from the fork of the leaves.

BELLWORT AND STAR FLOWER

Bellwort, a member of the Lily Family, is very abundant in the woods in early spring. It has a graceful curving stem about eight inches high, several lance-oblong pale leaves set close to or clasping the skin, and beneath the leaves one or two modest lily-like yellowish or straw-colored drooping flowers. It is common over the eastern half of America.

Much resembling the anemone, but belonging to a different family, is the Star Flower, or the Star Anemone. It has a slender erect stem, bearing at the summit a whorl of from five to ten thin pointed leaves; and above the whorl of leaves, borne on a short petiole, is a white delicate star-shaped flower with seven divisions. The whole effect of plant, leaf and blossom is starry and pointed. The flower secretes no honey, but it is visited by small bees searching for pollen, which is thus transferred from one flower to another and cross-fertilization is brought about.

GOLD-THREAD, A FLOWER OF THE BOG LANDS

A beautiful little plant, whose shining three-parted evergreen leaves carpet swampy bogs throughout the year, is the Gold-thread, which has received its name because of its golden yellow thread-like roots. Its delicate white flowers, with from five to seven club-shaped petals and numerous stamens, are solitary on slender scapes from three to five inches high. The pistil consists of from three to seven parts, which ripen into divergent pods, borne on slender stalks, and bearing long, tapering styles. Gold-thread is one of the best known of all our wild flowers because of its beauties and its uses. A wash from its bitter yellow roots is used for ulcerated throats; and the plant is regarded by some people as an excellent tonic. The Indians used the roots to make a yellow dye for their clothes and paint for their faces.

BERRIES WHICH ARE AS ORNAMENTAL AS FLOWERS

White Baneberry is a common plant in cool, shady nooks near streams from the Atlantic to the Pacific Ocean. The stem is about two feet high, the leaves are twice- or thrice-compound with incised and sharply toothed leaflets, and the flowers are very small, and borne in thick oblong terminal feathery clusters. In midsummer the fruit is a very conspicuous feature of the woods. The flower-clusters have given place to a cluster of oval white berries, each with a dark spot on it and each borne on a thick red stem. The berries are not edible. An earlier species, the Red Baneberry, blossoms a week or two sooner. It produces cherry-red berries borne on slender stems. Curious variations, probably due to intercrossing of the species, are found in the fruits of these plants.

THE WILD COLUMBINE, WHICH LOVES THE ROCKY PLACES

Emerson said:

A woodland walk,
A quest of river grapes, a mocking thrush,
A wild-rose or rock-loving Columbine,
Salve my worst wounds.

The Wild Columbine is from one to two feet high, with branching stems bearing many much-divided leaves with lobed leaflets, and large nodding attractive flowers of five brightened petal-like sepals and five petals in the form of large hollow spurs which are red without and yellow within.

The graceful Columbine all blushing red,
Bends to the earth her crown of honey-
laden bells.

The flowers contain much nectar, which is eagerly sought by bees and humming-birds. The many stamens and the long styles of the five pistils project from the flower as a delicate golden fringe. Many species and varieties of Columbine in different colors, such as blue, purple and white, are cultivated, and these sometimes escape and grow wild in some parts of the country.

THE FOAM-FLOWER AND THE BISHOP'S CAP, MITERWORT, TRUE AND FALSE

In rocky woods and on hillsides in early spring the beautiful clusters of Foam-flower, or False Miterwort, are found. The stem is from five to twelve inches high and is usually leafless, with one or two heart-shaped sharply lobed leaves growing at the base from the underground stem. The foamy white flowers, each with a five-parted calyx, five petals on claws, and ten long and slender stamens, are borne in a cluster at the top of a slender stem rising about eight inches above the ground. The seed-pod has the form of a bishop's cap or crown, hence the generic or family name *Tiarella,* meaning "turban" or "crown."

In rich woods, but blossoming later than the foam-flower, is found the True Miterwort, or Bishop's Cap. The raceme is more slender and open, and the few flowers are smaller, more delicate and crystal-like. Both species are common in eastern Canada. Another species of miterwort, blooming at the same time, and common in swamps from the Atlantic to the Pacific, has long slender runners, from which are produced rounded or kidney-shaped leaves with deep round teeth, and a clothing of soft hair. The flowers are small and greenish, and are arranged in a loose cluster at the top of a slender stem.

A PLANT WHICH HAS NEVER GAINED A COMMON NAME

Clintonia borealis, a beautiful plant without a common name, but usually called Clintonia, shows its three or four dark green shining leaves sheathing a stem at its base, at all times in summer. In May or June it sends up a scape from four to eight inches high, bearing a cluster of drooping greenish yellow bell-shaped flowers. Each flower has a perianth of six colored sepals, six protruding stamens and one pistil—a member of the Lily Family. Later in the season the cluster of flowers gives place to a cluster of blue oval berries, which are beautiful in contrast with the rich green foliage which carpets the woods.

Toothwort is a pretty spring flower common in rich, moist woods. It has other common names, such as Crinkle-root and Pepper-root, descriptive of the pleasant, pungent flavor of its wrinkled toothed rootstock or underground stem, which is crisp and edible, and used to flavor many a simple luncheon in the cool shadows of the forest. The stem is leafless below, but bears above two leaves, each divided into three toothed leaflets. The flowers are white, in a terminal cluster. Each flower has four sepals which drop off early, four white petals and six stamens, of which two are shorter than the others. These are characteristics of the Cress Family, which belongs to the same order as cabbages, stocks and sweet alyssum.

SOLOMON'S SEAL, AND ITS IMITATION

Any story of common spring flowers would not be complete without a reference to Solomon's Seal, the blossoms of which appear in May. The stem is slender, curving, and from one to two feet long. The leaves are alternate, oval, and set close to the stem. The yellowish bell-shaped flowers, singly or in twos, nodding from the axils of the leaves, are fastened to a slender flower-stem so fixed into the axil of the leaf that the flowers droop beneath each in a graceful curve, which is sustained in later summer by the dark blue berries. The rootstocks are marked with large round scars somewhat resembling the impression of a seal upon wax, and this suggested the common name.

Wild Spikenard, often called False Solomon's Seal, is a handsome and common plant in some localities. It resembles the true Solomon's seal only in the leafy stem, which is usually curving and from one to three feet long. The flowers are greenish white, small, and in a terminal raceme, at the end of the leafy stem. The leaves are large, oblong, veiny, and clasp the stem alternately. The fruit is a pale red berry speckled with purple, and the clusters of ripe berries are found in the late summer months.

Another member of the Lily Family, which flowers in May and June in moist woods is the so-called Canada Mayflower. It has a cluster of small white flowers rising just above two clasping, broadly ovate leaves.

TWISTED STALK AND CELANDINE

The Twisted Stalk somewhat resembles Solomon's seal, with which it is found blossoming in the woods in May and June. The stem is rather stout and zigzag, and bears taper-pointed, slightly clasping leaves. The whole plant presents a graceful group of forking branches and pointed leaves; and on picking up a branch one finds beneath each of its outspread leaves one or two slender bent stalks, from which hang the dull purplish pink bell-like flowers. In autumn it bears round red berries.

> There's a flower that shall be mine,
> 'Tis the little Celandine.

Thus wrote Wordsworth of a plant with golden yellow clustered flowers, each with two sepals, which fall early, four petals and sixteen or more stamens. The stem is brittle, and gives a saffron-colored acrid juice when broken. The leaves are much divided, and the seed-pods are long and slender. Celandine is a European plant now common on roadsides in eastern Canada. In Europe it is called Swallow-wort, because it is supposed to commence flowering when the swallows come and cease when they depart.

THE PRETTY FEATHERY FLOWER OF THE BUCK-BEAN

In May or early June we are tempted deep into the long grass of a swamp by the beautiful white flowers of Buck-bean. The flowers are clustered along the upper part of a scape about one foot long. Often they are reddish before opening. The calyx is five-parted and the corolla is five-cleft, funnel-form and fringed on the upper surface with a white beard, which gives the flowers a beautiful feathery appearance. The leaves are long-stemmed, and each is divided into three oblong leaflets. The Wild Bean, or Ground-nut, which blossoms in late summer, belongs to another family, and is a true bean. It has a twining stem, which climbs over bushes in thickets. The leaves are divided into from three to seven narrow oval leaflets, and the violet-scented purplish or chocolate-colored flowers, in close clusters, are shaped like a pea blossom. On its underground stems are many edible enlargements shaped like a pear, which suggested the name Ground-nut.

A PLANT THAT CATCHES AND EATS INSECTS

One of the most curious of all our plants is the Pitcher Plant, common in peat-bogs and swamps from the Atlantic to the Pacific. The plant bears, close to the ground, a cluster of hollow cup-like leaves which are reddish without and pale green streaked with crimson within. The cups are broadly winged at the side and hooded above. These cups not only attract attention by their peculiar pitcher-like shape and rich markings, but they arouse curiosity because of the trap they set for insects. They are partly lined with a sweet juice, below which, for a short space, they are highly polished; while below the slippery surface there are stiff hairs pointing downward. The cups are usually partly filled with water. Insects are thus easily entrapped and drowned in the water. Thoreau wrote: "Though the moss is comparatively dry, I cannot walk without upsetting the numerous pitchers which are now full of water and so wetting my feet." The name Huntsman's Cup is often given to the plant.

THE FLOWER OF THIS CURIOUS PLANT

The flower of the pitcher plant appears in early June, and is not less interesting than the leaves. It is red or dull purple, large and nodding, and suggests by its form the name Side Saddle flower. The five sepals are red or purplish, and each has three brackets at the base. The corolla has five fiddle-shaped red petals which are arched over the greenish yellow style. There are numerous stamens, and the pistil has a five-celled ovary with a short style expanding at the top into a five-rayed umbrella, under the angles of which the stigmas are placed. It is thought that the plant absorbs the digested bodies of the insects entrapped, and thus supplements the small supply of nitrogen it receives from the somewhat poor soil in which it grows. It is therefore an example of a "carnivorous" plant.

THE FLOWERS OF BEAUTY AND OF MYSTERY

The Orchids are among the most mysterious of all wild flowers. Many species are found in North America, but many of them are inconspicuous and rare. A certain fascination attends the very name of orchid, which suggests visions of tropical regions where, most beautiful and sometimes dangerous, they grow to perfection. "Deep hidden in the damp recesses of the leafy woods" throughout the whole East the Showy Orchid appears in May. It has a four-angled stem with leaf-like bracts rising from fleshy fibrous roots, two oblong shining leaves from four to six inches long, and purple-pink flowers in a loose spike terminating a scape. The flower is very irregular in shape, due to the fact that the base of the perianth is closely attracted to the ovary, and only the upper portion is free. The sepals are colored and petal-like.

One of the petals differs much from the others in form and position, and is called the "lip." It serves as a sort of platform on which insects alight. In the showy orchid it is white in color and wavy in outline. The other petals and the sepals are pinkish purple, and united to form a hood which overarches a column composed of a single stamen closely united with a style and stigma. The tip turns down in such a way as to give bees and other insects easy access to a store of nectar at the inner end of the lip near the base of the column. The fine pollen grains are inclosed in a filmy covering, which is ruptured by the head of the bee. The sticky disks of pollen cling to the bee and are carried to the stigma of another flower. The whole structure of the flower seems admirably adapted to bring about cross-fertilization of flowers by means of bees. After pollination the flowers quickly wither and the ovary grows into a pod filled with many tiny seeds. All orchids produce thousands of seeds, but notwithstanding the fact that they seem to possess every natural adaptation to bring about perpetuation of the species, orchids are never very abundant.

Blossoming at about the same time, another member of the Orchid Family, *Calypso borealis,* is found in cool bogs and damp woods, burying its bulbs and coral-like roots in damp moss. "Even when her sanctuary is discovered, Calypso does not always reveal herself. The ground and the fallen tree-trunks are thickly padded with moss and embroidered with trailing vines of snowberry and Linnæa; painted trilliums dot with their white stars the shadows lying under the tangled fragrant branches; the silence of the forest, disturbed only by the chirr of a squirrel or the sudden jubilance of the oven-bird, envelops you and seems the proper accompaniment of such an expedition.

"You follow, perhaps, a winding path made by the wild animals among the underbrush, moving slowly, and you easily overlook the dainty blossoms nestling in some soft, damp nook and poised lightly on its stem as if ready to flutter away between your covetous fingers." The plant consists of a single thin ovate or slightly heart-shaped leaf from a solid bulb, and a variegated pink and yellow flower with a sac-shaped inflated lip, two-parted and bearded with yellow and pink. The flower is so exquisite that its discoverer named it after an immortal.

THE MANY VARIETIES OF THE LADY'S SLIPPERS

The charm of the Lady's Slipper never wanes. There are several species. One of the earliest, the Stemless, or Pink, Lady's Slipper, is found under hemlocks and pines in early June.

Graceful and tall the slender, drooping stem,
With two broad leaves below,
Shapely the flower so lightly poised between,
And warm her rosy glow.

There are two large oval veiny leaves lying close to the moss and sheathing the base of a scape from eight to twelve inches high, bearing at its top a solitary pink flower with a veiny lip and an inflated pouch. In all species of *Cypripedium* (Lady's Slipper) the lip is swollen and sac-like, forming a nectary. The column is unlike that of the other orchids. A single anther, usually present, is sterile, and forms a flap which overhangs the stigma. Two fertile anthers are attached to the under-side of the column. The flower is fertilized by the common bumblebee, which forces its way in through the fissure in front. After eating he takes the easiest way out, toward the base, where he can see two spots of light. As he forces his way out, the pollen on his back is rubbed off by the sticky stigma. As he struggles out of the flower, an anther, which blocks the passage, clasps its load of pollen on his back, and this is carried to another flower, where the whole process is repeated. Thus cross-pollination of flowers is insured and self-pollination is rendered impossible. Six other species of lady's slippers have been observed.

The Pink Lady's Slipper.

The Yellow Lady's Slipper blossoms a few days later than its pink sister. The leaves are alternate, broadly oval, many-veined and plaited. The stem is two feet high, downy, leafy to the top and one- to three-flowered. The flower is large, with a pale yellow lip forming an inflated pouch, and two long narrow wavy brownish lateral petals which give the flower an alert, startled look when surprised in its lonely hiding-places. The Showy Lady's Slipper is usually regarded as the most beautiful of all. The flowers are large and white, with the much-inflated lip, about two inches long, pink in front. The stem is leafy, from one to two feet high, and bears at its summit the solitary blossom. It is found in rich woods during June and July.

Two yellow lady's slippers blossom from May to July. The Small Yellow Lady's Slipper grows in swamps from Ontario to the Rocky Mountains. It bears "golden slippers meet for fairies' feet." The flower is fragrant and graceful, and has a deep yellow sac and reddish brown sepals and petals. The Ram's-head Lady's Slipper occurs in cedar and tamarack swamps, but is not common. It bears three or four leaves at the base of a low stem, and a solitary purplish drooping flower, with projecting horns and ears, headed by a tuft of wool.

Here is a message from the wild flowers, translated into our language by Bliss Carman, poet laureate of Canada:

We are the roadside flowers,
Straying from garden grounds,—
Lovers of idle hours,
Breakers of ordered bounds.

If only the earth will feed us,
If only the wind be kind,
We blossom for those who need us,
The stragglers left behind.

. . . .

Who shall inquire of the season,
Or question the wind where it blows?
We blossom and ask no reason.
The Lord of the Garden knows.

THE NEXT STORY OF PLANT LIFE IS ON PAGE 6576.

ACIDS

BASES

SALTS

THE magician turns "wine into water," red to blue; he performs many color tricks. These changes and many others can be understood by a knowledge of acids, bases and salts.

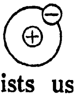
Add a few drops of vinegar to blue litmus —a dye that may be prepared from the juice of very simple plants called lichens. The blue litmus turns red. Lemon juice and carbonated waters will also turn blue litmus red. Vinegar is essentially water that contains some acetic acid, the substance that imparts to vinegar its sour taste and sharp odor. The sour taste of lemons and of many berries is due to citric acid. Carbonated beverages contain carbonic acid. Almost all substances called acids when dissolved in water do two things: they turn blue litmus red, and they give a sour taste.

Acids are found in all plants and animals, in the home, and in laboratories. Tartaric acid may be obtained from grapes; lactic acid is produced from milk sugar by the action of bacteria; oxalic acid, a poison, is found in very, very small quantities in spinach and beets, and gives rhubarb its sour taste. Hydrochloric acid is found in the gastric juice of the stomach and is essential to health. It is needed for the digestion of protein foods. Your mother's medicine chest contains a solution of boric acid to be used as an eye wash. Sulfuric acid and hydrochloric acid are usually found in laboratories.

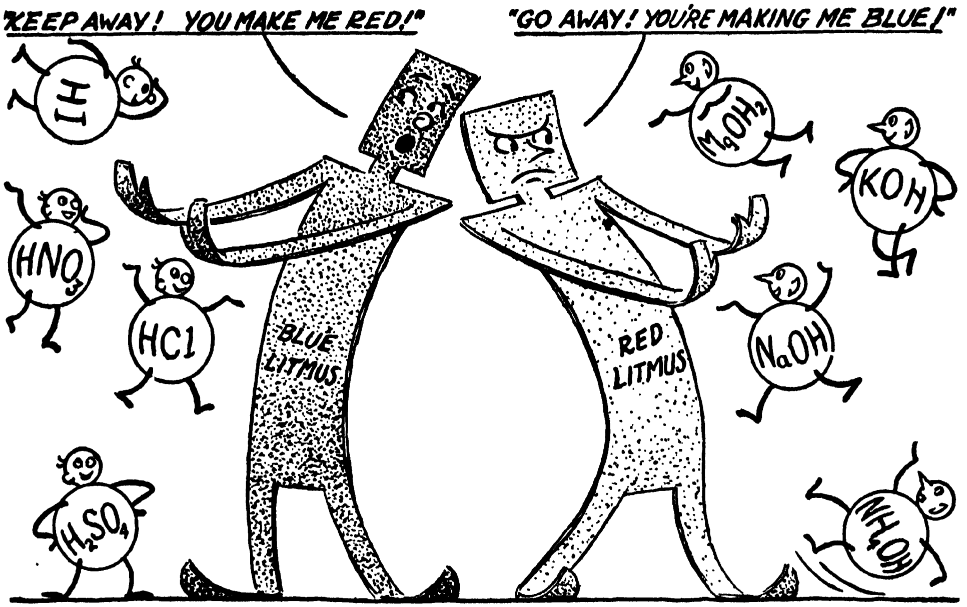
What is an acid? What is responsible for the power it has to change colors, and for the sour taste that its solutions possess?

All the substances in the world, as far as we know, are made up of one or more little pieces called atoms, a word that the atomic bomb has made so popular. Even these atoms may be broken up because they, in turn, contain tiny particles. In the center of the atoms are protons, and usually neutrons. Traveling around this center, or nucleus, are electrons. Atoms contain the same number of protons as electrons. A proton has a positive electric charge; and an electron has a negative electric charge.

The simplest of all atoms is the hydrogen atom. It contains just one proton—represented as ⊕—in its center, and one electron, —represented as ⊖—moving around the proton of the atom. It may be pictured as



Now, the chemists use an abbreviated style of writing. The atoms are represented by a letter or two called a symbol. The atom


"KEEP AWAY! YOU MAKE ME RED!"
"GO AWAY! YOU'RE MAKING ME BLUE!"
HI
HNO3
HCl
H2SO4
BLUE LITMUS
RED LITMUS
Mg(OH)2
KOH
NaOH
NH4OH

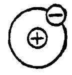
Acids have the property of turning blue litmus red, while bases are able to change red litmus to a blue color.

of hydrogen is H; oxygen is O; chlorine, the gas used to disinfect swimming pools, is Cl; nitrogen, found in the air, is N; sulfur is S. Chemists put these letters, or symbols, together to form words or formulas.

H_2O is such a word, or formula. It stands for water. It means that in water, or ice, or steam there are two atoms of hydrogen for every one atom of oxygen. What does SO_2 mean? It is the formula of a substance, sulfur dioxide, that contains two atoms of oxygen to one atom of sulfur. It is a gas with a choking odor; it is produced when a match burns.

Let us now inspect the formulas of some acids commonly used in laboratories.

Hydrochloric Acid	HCl
Nitric Acid	HNO_3
Sulfuric Acid	H_2SO_4

They all contain one or more atoms of hydrogen. It is believed, however, that these atoms of hydrogen found in acids are stripped of their electrons—they are just protons. Hydrogen , without the electron becomes just ⊕, or a proton. An atom or group of atoms that has lost or gained one or more electrons is called an ion; losing electrons makes an atom positive, gaining makes it negative.

When acids are dissolved in water the protons separate from the rest of the atoms. We tell you more about this in the chapter on Ions, page 6079. The special characteristics of acids in solution we believe are due to the protons. They are responsible for the sour taste of acids, for turning blue litmus red, and for many other rather special properties.

Let us now perform another experiment. Add some ammonia water, the liquid used as a household cleansing agent, to a solution of litmus that has been reddened by a drop or two of vinegar. The red color turns back to blue.

There are many other substances that act the same way; we call them hydroxides, or alkalies. They belong to a class of materials called bases. Among them are: lye, a chemical used in cleaning out drain pipes; lime water, a solution of calcium hydroxide used with milk to prevent its curdling; potassium hydroxide, important in the manufacture of shampoos; and milk of magnesia, or magnesium hydroxide. Most of these hydroxides have a bitter taste, and feel soapy and slippery to the touch.

Let us inspect the formulas of some hydroxides to find out what makes them act as they do. Some of the common bases are:

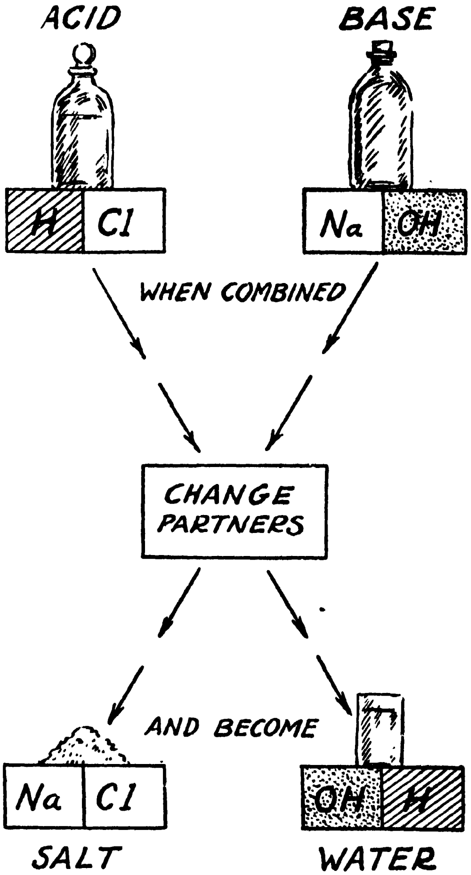
Sodium Hydroxide	$NaOH$
Potassium Hydroxide	KOH
Ammonium Hydroxide	NH_4OH

Hydroxide refers to the combination of an atom of hydrogen and an atom of oxygen, These two atoms, and one electron, often cling together and they form a group called the hydroxide ion. This hydroxide ion is represented as OH^- (the minus represents the electron, the negative charge). When these bases are dissolved in water, the hydroxide ion, OH^-, separates from the rest of the compound. The special characteristics of hydroxides—turning red litmus blue, the bitter taste, the slipperiness—are due to the hydroxide ion (OH^-).

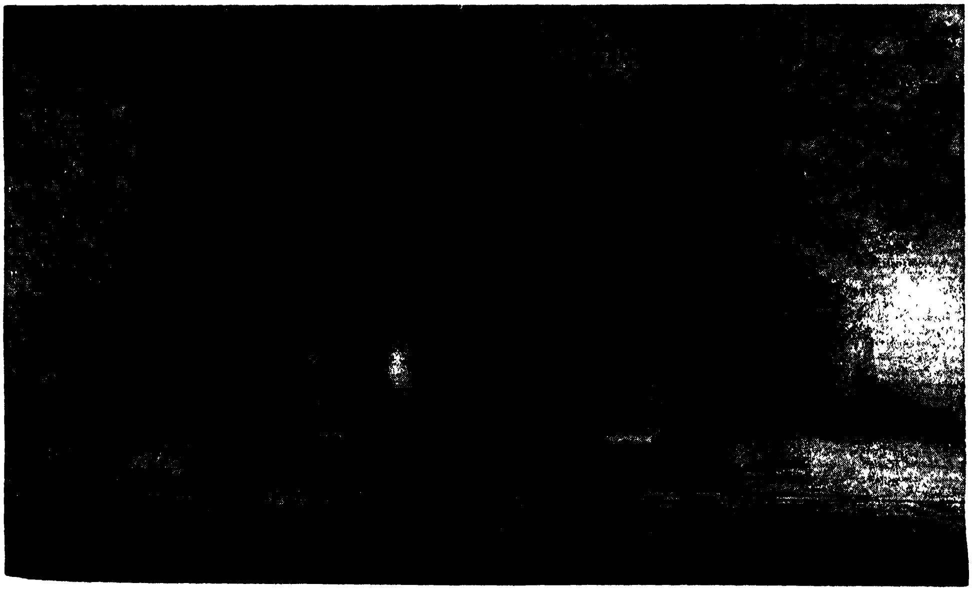
So, then, acids contain protons, or, which is the same thing, hydrogen ions; and common bases contain the hydroxide ions. What, now, are salts?

An experiment will help to answer the question. A great deal is learned by doing experiments quantitatively, that is, by weighing and measuring. The experiment to be described here is quantitative.

Forty grams (28.35 grams = 1 ounce) of the base sodium hydroxide are dissolved in one liter (about a quart) of water. A few drops of red litmus are added. The entire solution turns blue. Now, dry hydrochloric acid, a gas, is slowly bubbled into the solution, with constant stirring. When 36.46



Common table salt, sodium chloride, is obtained from this cavern, 550 feet below the earth's surface. It is also obtained commercially by evaporating natural salt water.
Ewing Galloway



grams of the gas have been bubbled in, the entire solution turns purple—a color intermediate between blue and red. The solution no longer tastes bitter. It is very salty. In fact, it is now salt water. Crystals of common table salt may be obtained by boiling off the water.

As we boil off the water, the steam might be passed through a condenser and changed back to water. The water could then be measured. What a surprise! Instead of one liter of water (the quantity we began with), there are now one liter and eighteen cubic centimeters (1 liter = 1000 cubic centimeters). Water has been made. How was it done?

As we have said, water—H_2O—contains two atoms of hydrogen to one atom of oxygen. Sodium hydroxide is NaOH and hydrochloric acid is HCl. The two atoms of hydrogen and one atom of oxygen formed water, or, in the terms of ions

$$H^+ + OH^- \longrightarrow H_2O$$

H^+ is the same as a proton ⊕. It is written H^+ to show that the hydrogen atom has lost an electron, and has become positively charged. The chemical sentence or equation showing this experiment is written:

$$\mathrm{Na}\ \boxed{\mathrm{OH+H}}\ \mathrm{Cl} \rightarrow \mathrm{H_2O+NaCl}$$

$$\mathrm{Na^+ +}\ \boxed{\mathrm{OH^- + H^+}}\ \mathrm{+ Cl^- \rightarrow H_2O + Na^+ + Cl^-}$$

We started with NaOH and HCl. The OH^- and H^+ combined to form water—H_2O. That left Na^+ and Cl^-. These combined to form NaCl, which is sodium chloride or common salt.

The base, sodium hydroxide, and the acid, hydrochloric acid, seem to be opposites. The solution of the base turns litmus blue and the solution of the acid turns it red. The solution of the base is bitter and that of the acid sour, and when they meet they destroy each other by forming water and salt.

What happens when other bases and acids meet?

Consider potassium hydroxide, KOH, (K is potassium, known also as kalium) and hydriodic acid, HI. (I represents iodine.) Let us write a chemical equation.

$$\mathrm{K}\ \boxed{\mathrm{OH+H}}\ \mathrm{I} \rightarrow \mathrm{H_2O+KI}$$

$$\mathrm{K^+ +}\ \boxed{\mathrm{OH^- + H^+}}\ \mathrm{+ I^- \rightarrow H_2O + K^+ + I^-}$$

Once more water is formed! Every base contains the hydroxide ion OH^-; every acid contains the hydrogen ion H^+. These two ions form H_2O when joined together. Whenever a base and an acid react, water is

Seasoning with poison! The salt which the chef uses to flavor the food is composed of the metal sodium and the poison gas chlorine. When the two elements combine, each atom of sodium gives away one electron to each atom of chlorine. The sodium becomes a positively charged ion and the chlorine a negatively charged ion. They are attracted to each other, forming sodium chloride—common table salt.

formed. We say they neutralize each other. Besides water, another substance is formed. We call it a salt. It may be $NaCl$, or KI, or ammonium chloride—NH_4Cl—or one of many other salts.

The word salt originally referred only to common table salt, sodium chloride, $NaCl$. In the course of time, the meaning of the word was extended to cover many other substances which resemble salt, and finally, any substance, besides water, which could be derived from an acid and a base.

The neutralization of an acid by a base may then be expressed as

$$\text{acid} + \text{base} = \text{water} + \text{salt}$$

Let us list some salts found in the home or used in industry, and show the acids and the bases to which they are related:

Sodium chloride, common table salt,

	base	acid
$NaCl$	$NaOH$	HCl

Magnesium sulfate, Epsom salts,

	base	acid
$MgSO_4$	$Mg(OH)_2$	H_2SO_4

Ammonium chloride, sal ammoniac, used in the little dry cells found in flashlights,

	base	acid
NH_4Cl	NH_4OH	HCl

Observe that the salt contains a part of the base and a part of the acid. Those parts are known as the metallic radical and the acid radical. A salt may be defined as a substance that contains a metallic radical and an acid radical.

Salts, acids and bases may be produced in many ways. One of these ways—their building up from elements—will now be discussed. Let us consider the making of common table salt, sodium chloride, from the elements sodium and chlorine.

Sodium is a good conductor of electricity and, when untarnished, has a silvery luster. It resembles aluminum and iron, and is a metal. Sodium combines with oxygen readily, and it can not be kept in the air. It is usually stored under a fluid like benzene.

Chlorine is a greenish yellow gas. It is used in small quantities as a disinfectant in pools and to purify drinking water. The gas itself is poisonous and a full breath of pure chlorine may be fatal.

In our experiment, sodium is heated until it melts. The silvery liquid is put into a bottle of chlorine gas. There are sparks and noise and heat. The bottle may break. The sodium and chlorine disappear. Instead there is a white salt—sodium chloride.

What a change! Chlorine, a deadly poisonous gas, combines with the metal sodium to form an entirely new substance that is used as a seasoning for our food!

What happened? We believe that each atom of sodium gave away one electron to each atom of chlorine. The sparks and the heat revealed the movement of these electrons. The atom of sodium (without this one electron) has one extra proton; it is a positive ion. The atom of chlorine, with its borrowed electron, becomes a negative ion. Now, a positive ion is attracted to a negative ion and so these ions stay together. Sodium chloride is formed.

Atoms of metals tend to combine with atoms of non-metals by giving electrons to the non-metals. We may use symbols to tell

Turning "wine into water" with the aid of chemistry. Acids and bases have the ability to change colors.

the story of what takes place in this case.

$$\text{Na} - 1\ \text{electron} \rightarrow \text{Na}^+$$
$$\text{Cl} + 1\ \text{electron} \rightarrow \text{Cl}^-$$
$$\text{Na}^+ + \text{Cl}^- \rightarrow \text{NaCl}$$

Let us now study the building of the base, calcium hydroxide, found in lime water.

Calcium, like sodium, is silvery when untarnished, it conducts electricity, and it gives electrons to non-metals.

When calcium is heated and then put into a bottle of oxygen, a vigorous reaction occurs. There are light, heat and sparks. A white powder—calcium oxide—is formed. When the calcium oxide is put into water a great deal of heat is produced; some of the water may start boiling, and calcium hydroxide is formed. Let the equations tell the story.

$$\text{Ca} + \text{O} \rightarrow \text{CaO}$$
$$\text{Ca}\ \underbrace{\boxed{\text{O}+\text{H}}\ \text{OH}}_{\text{H}_2\text{O}} \rightarrow \text{Ca(OH)}_2$$

Now each atom of calcium lost two electrons as it combined with oxygen. Ca(OH)_2, therefore, contains one calcium ion, Ca^{++}, and two hydroxide ions, $2(\text{OH})^-$.

Let us now consider the building of an acid, like sulfurous acid. We must start with a non-metal, with sulfur. Heated sulfur burns in oxygen to form a choking gas, sulfur dioxide. When sulfur dioxide is mixed with water, an acid, called sulfurous acid, is produced,

$$\text{SO}_2 + \text{H}_2\text{O} \rightarrow \text{H}_2\text{SO}_3$$

This acid will turn a wine-colored solution of potassium permanganate colorless—the "wine to water" trick of the magicians. This acid is used to bleach and preserve fruits, to bleach silk and wool.

A study of sulfurous acid shows that it, too, contains ions—hydrogen ions, H^+, and sulfite ions, SO_3^{--}. It has two hydrogen ions for each sulfite ion. Each sulfite ion has two extra electrons.

Some of the ideas about the chemical nature of acids, bases and salts may be brought together.

1. Elements, generally speaking, may be divided into metals and non-metals.
2. Metals and non-metals combine to form salts.
3. Bases, generally speaking, may be built from metals.
4. Acids, generally speaking, may be built from non-metals.
5. Acids and bases neutralize each other to form water and a salt.
6. Acids, bases and salts all contain some positive ions (an atom or a group of atoms with more protons than electrons) and some negative ions (an atom or a group of atoms with more electrons than protrons).

These three classes of compounds—compounds composed of ions—are called electrolytes.

Salts, such as those in milk, are needed in the body. They help to keep organs and tissues chemically balanced, which is necessary for good health.

Acids, bases, and salts are found in all plants and animals. The very life of organisms depends on them.

In the gastric juice of our stomach there is present a certain amount of hydrochloric acid. The protein foods we eat will not undergo the changes necessary for building up our bodies unless this acid, HCl, is present. Doctors often prescribe very dilute hydrochloric acid (mixed with a great deal of water). On the other hand, too much acid is very harmful. There are streams on the slopes of the Andes Mountains in which no fish can live because these streams contain large quantities of hydrochloric acid.

The blood and tissues, in general, must be faintly on the base side. Any appreciable increase in the number of hydrogen ions, H^+, (acidosis), or of hydroxide ions, OH^-, (alkalosis), in the blood may be very dangerous.

Certain salts, such as sodium bicarbonate, (also known as bicarbonate of soda, or bicarbonate) help to regulate the number of hydrogen ions and the hydroxide ions. These salts are known as buffers. A buffer is a salt, or a mixture of salts, which will keep the acidity or the alkalinity of a solution very much the same, even if a moderate amount of acid or base is added. The following equations show how sodium bicarbonate, $NaHCO_3$, may act as a buffer.

Suppose an acid, such as hydrochloric acid—HCl—is added to a solution of sodium bicarbonate:

a. $Na\ \boxed{HCO_3+H}\ Cl \rightarrow H_2CO_3+NaCl$

b. $H_2CO_3 \rightarrow CO_2(gas)+H_2O$

The bicarbonate ion combines with the hydrogen ion of the acid to form carbonic acid (H_2CO_3), which is a very unstable substance and breaks up into carbon dioxide and water. The hydrogen ion, H^+, of the original acid is no longer free. Water is formed.

Suppose a base is added, then,

$Na(H)CO_3+Na(OH) \rightarrow H_2O+Na_2CO_3$

The OH^- has been removed to form water.

Salts are needed in the body for many other reasons. Bones and teeth contain the salt calcium phosphate. Salts such as these are needed in the body to prevent rickets and other deformities.

Salts stimulate the muscles of the heart. Certain salts make the heart contract, other salts make the heart relax.

Blood contains NaCl, also KCl, $CaCl_2$, and $NaHCO_3$.

Another use of salts is to maintain the proper amount of water in the tissues of the body.

The various tissues in the body normally contain the amount of water best suited for them. One of the ways in which water, and other substances, pass in and out of these tissues is through certain partitions called semi-permeable membranes. Suppose two solutions containing different concentrations of salts are separated by one of these membranes. The amount of salt in the water is called its concentration. Enough will pass through the membrane so as to make the concentration equal on both sides.

Acids, bases, salts are also of great importance in industry. Sulfuric acid, for instance, is one of the most commonly used substances. Many of the characteristics of acids, bases and salts and their uses depend on their being electrolytes, or conductors of electricity, under proper conditions.

A plate of zinc is put into a solution of sulfuric acid contained in a battery jar. Bubbles of the gas hydrogen appear. Heat is produced. If enough acid is present all the zinc finally dissolves.

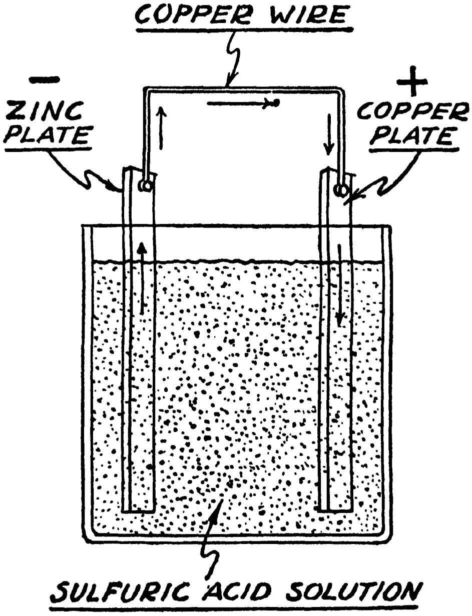
Now let us change the experiment slightly. The plate of zinc is placed against one side of the battery jar and a copper plate is placed against the other side. Both plates dip into the sulfuric acid. A metal wire is attached to each plate. If the two wires are permitted to touch, an electric current flows. The zinc, reacting with the acid, gives off electrons which travel over the wire. (A group of such cells is called a battery.) Compounds like sugar and glycerin can not be used to make such cells. Acids, bases and salts—compounds that contain ions—must be used.

If the two wires of the above cell are connected to a bell, the bell rings; if they are connected to a small electric bulb, the bulb lights up. It is the moving of the electrons, or, in other words, the flow of the electric current, that makes the bell ring and the bulb light up.

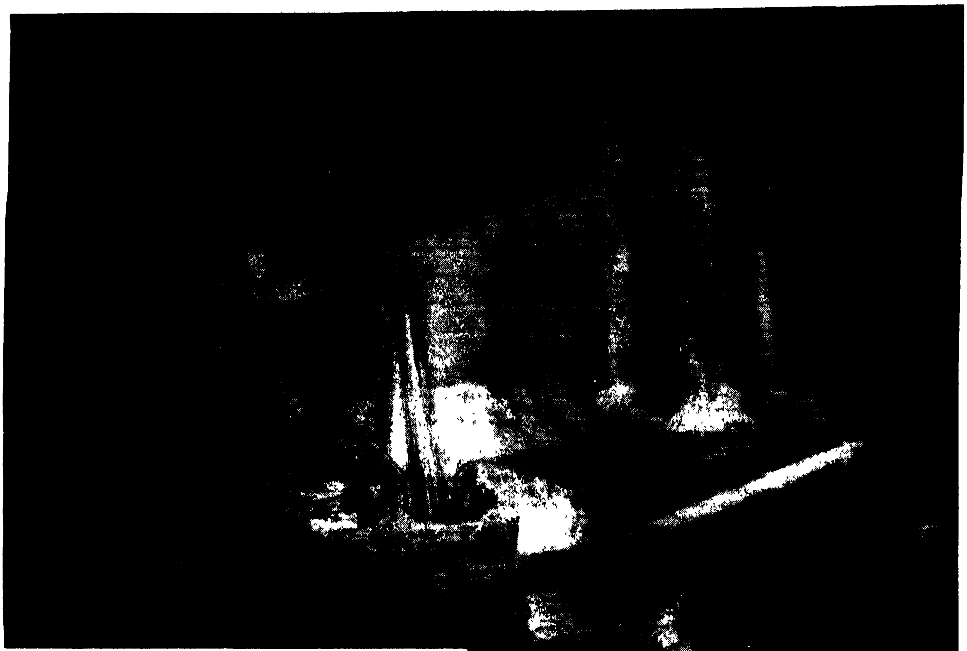
There are various kinds of batteries built on the above principle. The storage battery used in automobiles contains sulfuric acid; the dry cells used in flashlights contain the salt ammonium chloride; while the Edison cell contains the base sodium hydroxide.

Another characteristic common to electrolytes and not possessed by other compounds is that they can be decomposed—broken up—by means of an electric current. The process is called electrolysis.

Common salt is melted. The wires from a battery are put into the fused (melted) salt. Shiny globules of sodium appear at one



A group of elementary cells like this one is called a battery. The sulfuric acid attacks the zinc and releases electrons which flow through the wire.



Pictures, courtesy, The Dow Chemical Company

Magnesium metal is obtained from magnesium chloride by electrolysis. Above, molten metal being pumped through pipes at the rate of about 1,200 pounds per minute to a machine which forms it into blocks for shipping. Left, forming a magnesium automobile hub.

wire, chlorine gas at the other. In a similar manner, sodium hydroxide can be decomposed into sodium, oxygen and hydrogen.

Hydrochloric acid, in a concentrated solution, can be decomposed into hydrogen and chlorine. Certain compounds can not be decomposed even at the highest temperatures produced by electric furnaces. The fact that electrolytes may be decomposed by the electric current is therefore of great advantage in making new substances.

The metal magnesium which is used with aluminum to make light alloys for airplanes is made by electrolysis. Fused magnesium chloride, $MgCl_2$, is decomposed by electric current.

Related to electrolysis is electroplating of metals.

Let us consider the case of plating an iron spoon with silver. The spoon and plates of silver are dipped into a solution of silver cyanide dissolved in potassium cyanide. The spoon is connected by means of a wire to one of the plates of the battery, the negative pole. The silver plate is connected to the positive pole of the battery. The silver plate dissolves into the silver cyanide, and an equal amount of silver goes out of solution and plates the spoon.

Electrorefining of metals is similar to electroplating. The impure metal is connected to the positive pole of the battery, while a plate of the pure metal is connected to the negative pole. Both plates dip into a solution of the desired metals. In the case of the electrorefining of copper, for instance, the copper from the unrefined metal goes into solution and is finally deposited on the opposite plate. The gold and silver impurities fall as sludge to the bottom of the vessel.

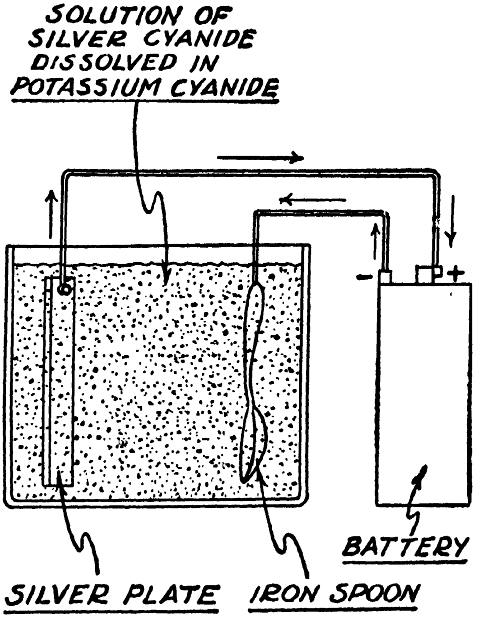
The solutions of acids, bases and salts conduct the electric current and can be used in the various processes involving electricity because they are composed of ions.

Water tends to separate the ions from one another, to overcome their electrical attraction. The ions, in water solution, tend to act as independent units. As a result, when different acids, bases and salts are dissolved in water and their ions are separated, these ions may meet and form new combinations. These new combinations, of course, mean new substances.

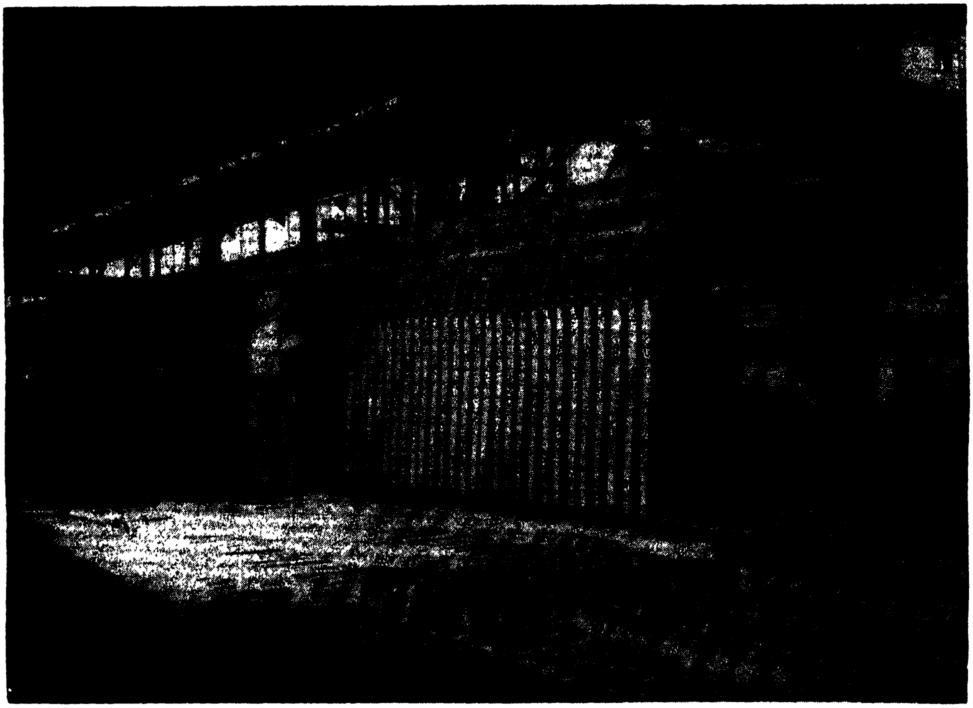
It is interesting to note the speed with which reactions of this type take place; the new materials are produced almost immediately. This is but one other remarkable characteristic of these ionic compounds.

By MORRIS MONDZAK.

THE NEXT STORY OF SCIENCE IS ON PAGE 6313.



Electroplating of metals is an important industry. As shown above, an iron spoon and a silver plate can be placed in a solution of silver cyanide dissolved in potassium cyanide. Current from the battery causes metallic silver to be deposited on the iron spoon.



Courtesy, The American Brass Company

Lowering positive plates of impure copper into an electrolytic cell. Much copper is refined in this way.

Culver Service

The Lady Godiva with her waiting women as she is leaving the castle on her memorable ride through Coventry.

HOW LADY GODIVA HELPED HER PEOPLE

WHEN Leofric the Dane was Lord of Coventry, England, in the year 1040, he heavily increased his taxes on the townsfolk. The people met together secretly, to try to find a way to move the hard heart of Leofric, and decided to appeal to Leofric's wife, the Lady Godiva, who was greatly beloved for her many gracious acts to the sick and the poor.

When she had heard their story, Lady Godiva pleaded with her lord on their behalf. At first he roughly refused to listen, but finally he promised to lighten the taxpayers' burden if his lady would agree to ride, unclothed, through the town. This he thought she would never agree to.

But her generous heart overruled her modesty. Besides, she felt sure that she could trust the townspeople to stay inside their houses and keep their shutters closed if she asked them to, while she carried out her difficult bargain with her lord.

So Lady Godiva sent word to the townsfolk. Then, partially veiled by her long beautiful hair she bravely mounted her palfrey, and rode from end to end of the town of Coventry.

True to their promise, everyone remained within doors as she rode, to spare their beloved benefactor any feeling of shame. Leofric kept his word to his wife. And to this day the citizens of Coventry delight to do honor to the memory of Lady Godiva.

THE NEXT STORY OF GOLDEN DEEDS IS ON PAGE 6393.

THE BOY WHO NEVER GREW UP

ALMOST seventy years ago there appeared in a small-town newspaper in Scotland a letter signed *Paterfamilias,* which means "father of a family." The letter strongly urged longer vacations for schoolboys. Very possibly the editor knew when the letter appeared on his desk that the writer was no father at all, but a young lad tired of lessons and eager for more time to play. With true Scotch humor and kindliness, the editor published the letter, the first of the writings of James Matthew Barrie to be set into print. Nobody paid any attention to his urgent plea for more playtime. But young James must have had a rich Scotch humor of his own, even then. He must have known that for him work would always be play and that the sight of his own words on a printed page would bring a deeper joy than winning a race or a cricket match.

He often said that he was born in a very Scottish part of Scotland, the little village of Kirriemuir, May 9, 1860. He was the ninth of ten children. His father was a hard-working weaver, his mother the daughter of a stonemason. James was sent to school in the town, then to the Academy at Dumfries where he wrote the letter on vacations. He also wrote at this time a childish novel, which he later destroyed, and a school play. He went to Edinburgh University, and after graduation he secured work on an unimportant newspaper in Robin Hood's old town of Nottingham. Soon, like most young Scottish and English men who want to be writers, he made his way to London.

The great city thrilled the boy from Kirriemuir. The clatter of its streets appalled him at first, but he soon loved the hurrying crowds, the impressive buildings and the bright theaters. He was the shyest little man in the world, yet he wanted to write for these crowds of city-folk. So he sat down and told them stories about the quiet small village of Kirriemuir, and the tears and laughter of its simple, hard-working people. He called Kirriemuir Thrums in his stories.

The trials of a timid, lovable minister with his stern flock, and the minister's love story, he wove into a novel, The Little Minister, that soon was being read with delight on every continent. It was made into a famous play, and years later into a motion picture. The life of a poor Scotch orphan boy, whose one talent was the gift of words, made Sentimental Tommy known to the whole reading world. The unimportant, the poor, the ridiculous, the childish became, in Barrie's works, heroes in miniature.

Philip D. Grendeau, N. Y.

James M. Barrie, beloved Scotch author, was born in this charming and simple cottage in Kirriemuir.

BARRIE'S MOST FAMOUS CHARACTER

Ewing Galloway, N. Y.

The fascinating story of Peter Pan is known almost universally throughout the English-speaking world. This statue of Barrie's famous little character stands in London's beautiful and historic old Hyde Park. The sculptor has somehow managed to capture much of the charm of the Barrie story itself.

One of his greatest triumphs of imagination was the play Peter Pan, the story of a little boy who refused to grow up. The play has been shown in nearly all parts of the world. It has also been made into a motion picture, and millions of people have laughed over the crocodile that swallowed the alarm clock, and the shadow that was locked in a bureau drawer, and have followed with mounting excitement the adventures in Never-Never Land. The play was born out of the following incident.

Barrie was frolicking with some small boys, favorite friends, and one of them, whose name was Peter, said, "I was wondering if you would ever grow up." That chance remark was the author's inspiration for the play. He named it after the child Peter and after Pan, a playful Greek god who had the face of an elderly man and the body of a sportive goat, an outdoor god of merriment.

PETER PAN WAS AS WELL RECEIVED IN NEW YORK AS IN LONDON

One of the characters in the play is a tiny meek fairy, Tinker Bell. When it was suggested to Charles Frohman, a famous New York stage manager, that he produce in America this fantasy which appealed so heartily to the people in England, he shook his head. "No, no," he said, "it sounds too silly. New York audiences would laugh at it." However, he went to see Peter Pan in London, and it captured his enthusiasm at once. Barrie's genius was so delicate that he could write scenes in which the most profound sadness was just around the corner from laughter, and sentiment over a fragile sprite like Tinker Bell was next door to plain Scottish good sense.

Frohman brought Peter Pan to New York and produced it with Maude Adams, a great American actress of the time, playing Peter. Miss Adams' reputation had been made as Babbie in the The Little Minister. A beautiful friendship developed between author, producer and actress, and many other plays were produced by them in the years that followed. This was, you must remember, the Golden Age of theater in America. Motion pictures were just starting and few thought they would ever develop into a form of entertainment that would compare with the regular stage. This happy friendship was broken by the death of Frohman, who went down in the Lusitania disaster, with Peter Pan's words on his lips, "To die must be a very great adventure."

Keystone View Co.

The author of PETER PAN in a reflective pose.

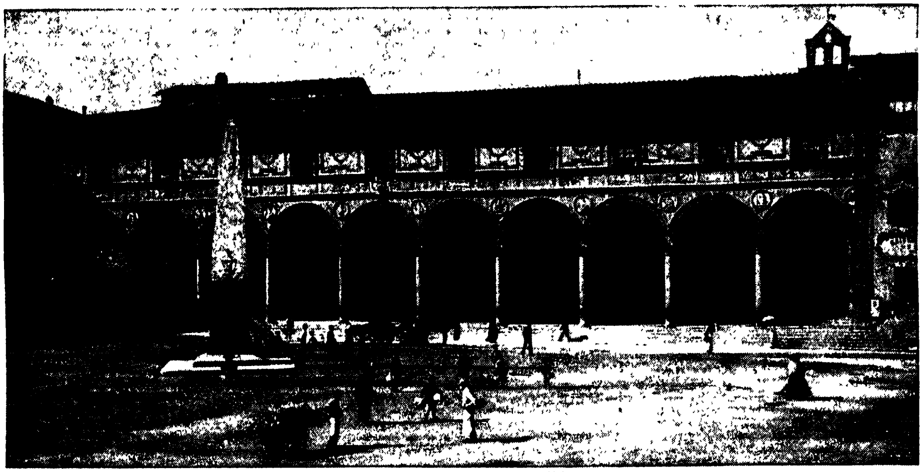
Barrie loved children, and since he had none of his own he became guardian to a real boy named Peter, Peter's four brothers and a young girl. This modest, shy, retiring man loved the thought of daring and was a friend and helper to many explorers. He gave money generously to Sir Robert Falcon Scott's Antarctic Expedition and when Scott knew that his end was near, he wrote a letter commending to Barrie's friendly care his son Peter, named after Peter Pan.

Years later, Barrie was asked to give an address before an audience of college boys. He showed them the pitiful stained scrap of paper, with Scott's words, written in that lonely Antarctic tent, and around it he wove a stirring message of courage to all youth.

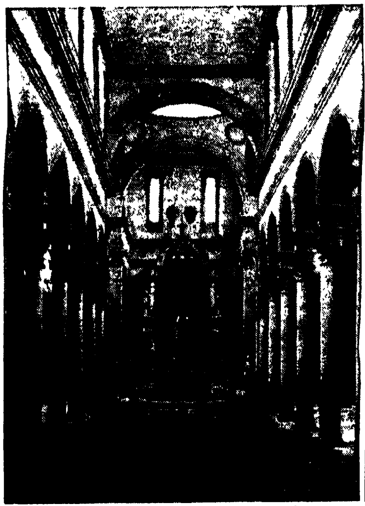
One of his most amusing bits stands with the *Paterfamilias* letter of his childhood. Barrie had the gift of friendship to an extraordinary degree, and it was thought that his charm would insure his success in politics, where his high ideals would make him a strong force for good in the country. He was invited to start a public career, by being chairman of a local meeting. Barrie went, against his will, and was so overwhelmed by shyness when he found himself on the platform that he failed miserably. Next day there appeared in the paper a cruel, mocking letter taunting him for his stupidity. His friends were furiously indignant. Not for years did they learn that he had written the letter. It ended his political career.

In 1913 King George V honored him with a baronetcy and in 1922 bestowed upon him the Order of Merit, a distinction limited to eleven living members. In 1937, Sir James Matthew Barrie died.

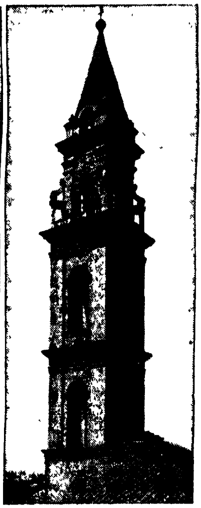
THE NEXT STORY OF MEN AND WOMEN IS ON PAGE 6325.



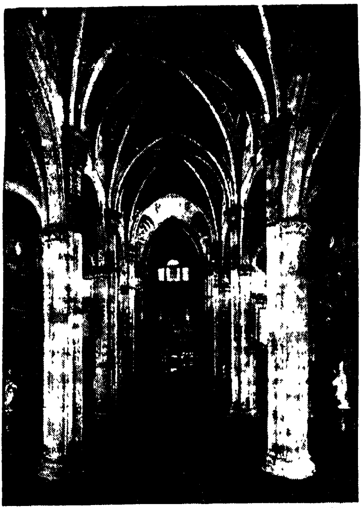
The Loggia of San Paolo in Florence.



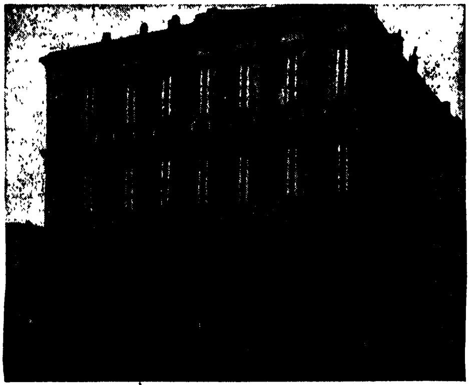
The Church of San Spirito in Florence.



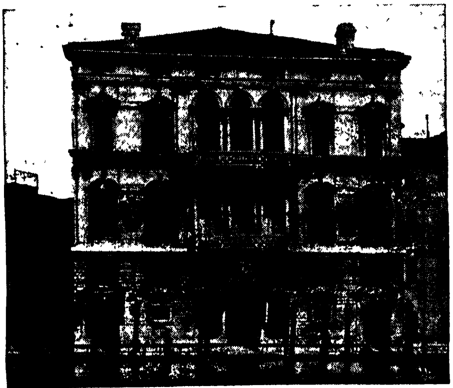
The Campanile of San Spirito.



Inside the Church of the Certosa of Pavia.

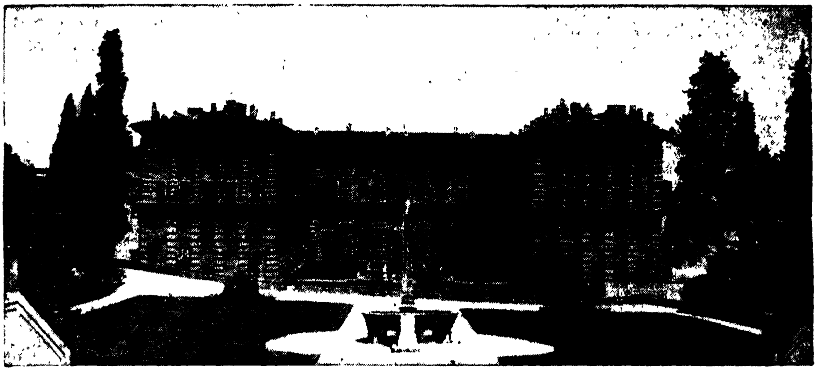


On the Grand Canal in Venice.



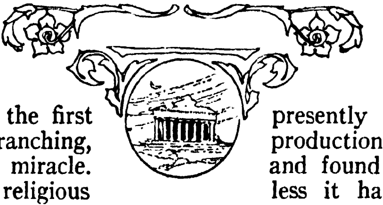
Balbi Palace in Venice.

Photos, Messrs. Alinari, Anderson, Brogi, McLeish, E. N. A., and others.



The back of the beautiful Pitti Palace in Florence.

THE RENAISSANCE IN ITALY



WE were last thinking of Gothic architecture, that vast growth which seemed, during the first hundred years of its branching, to be something of a miracle. It was, we remember, a religious architecture, and as such came to its end and died.

There have been revivals in Gothic—one of them produced a number of buildings in England during the last century—but there have never been any side developments of it. Nothing has been evolved out of Gothic suitable for municipal buildings.

The style which followed it rose in a country where the Gothic movement had found little favor—Italy. It bears the general name of Renaissance architecture; but this is quite distinct from the Renaissance in painting and sculpture which happened much earlier.

When Renaissance architecture was developed the Middle Ages were past. The invention of the printing-press had naturally opened up wider learning than in the days when the monks were the sole tutors of Europe.

The spreading of printed books throughout the Continent had two results—the Reformation and the Renaissance in architecture and literature. Books made men think, made men rub their eyes and dimly feel the loveliness of Greek and Roman art and literature. In reaction, they presently turned aside from productions of medieval Europe, and found nothing worthy unless it had the classic spirit. We call this intense interest in the history and literature of the past in the fifteenth and sixteenth centuries Humanism.

Besides these internal happenings there was an outside event of much significance. In 1453 Constantinople, the centre of Greek and Roman art and learning, fell to the Turks, and a great number of Greek scholars, fleeing from the conquerors, settled in Italy. They came at a time when the country was sensitive to their "touch," and the effect on Europe as a whole cannot be estimated.

Thus, after being forgotten for a thousand years or so, after centuries when the buildings of the old Roman Empire containing beautiful Greek statues had merely served as a quarry, classic art again triumphed in Italy, and produced, among other things, Renaissance architecture.

This new style, we must remember, which first appeared in Florence and her neighboring towns, was born of classic ideals, but it was not classic architecture simply copied in another country. It was an architecture that used classic ideals only in so far as they were suited to the needs of a new race. Therein lay its strength.

It grew slowly, like all great styles. From the outset it was as much suited to secular as to sacred buildings, and it was different from Gothic in that its construction was saner and capable of all kinds of development. It branched out in many directions, and to it most of the buildings of to-day can be traced.

THE DIGNITY AND STRENGTH OF THE BUILDINGS OF FLORENCE

When Florence took the lead in Renaissance architecture she was the queen of cities, and there were many jewels in her crown. She led Europe in the matter of art; her great industry and pride had created immense wealth and power; she was the strongest force in Italy. She was nevertheless at the mercy of the fortunes of war, within and without, and it was natural that her chief buildings should be in the style of fortress-palaces for her reigning princes, like the Medici.

There was plenty of fine stone and marble in Tuscany, and this material, being quarried in large blocks and set rough-hewn in the walls, gave at once a rugged character to the new architecture. The chief note of buildings like the Riccardi Palace and the Pitti Palace in Florence is enormous strength combined with fine dignity.

The architects seemed to begin these great palaces with the idea of a four-square fortress, and made as few openings on the ground floor as possible. One can easily imagine the Riccardi standing a siege. In the higher stories the buildings seemed to breathe a little—set with tall, rounded windows in unbroken regularity. Sun screens catch the light and make patches of shadow on the stonework. Then, surmounting all, a huge cornice ran its unbroken line round the building and seemed to frown down on the narrow street with its gaily dressed passers-by.

THE FINE FINISH A CORNICE GIVES TO A BUILDING

The Riccardi, famous forever because of the Medici, for whom it was built about 1430–34 from the designs of Michelozzo, is the most fortress-like of these early Tuscan palaces. It was known as the palace of the Medici, and took its present name only when, in 1659, the Marquis Riccardi became its owner.

The Strozzi Palace is another of these fine rugged buildings, set up in 1489. Two architects, Da Majano and Cronaca, worked on it. Cronaca also built the Guadagni Palace. The Ruccellai Palace, erected about 1450, marks a slight change. It has no cornice—suffering a little thereby, for that frowning line finishes a building in a very fine way—and on the Ruccellai appear for the first time the classic pilasters which became such a feature in Renaissance architecture.

Among these princely houses the Pitti Palace stands as chief, famous the world over. It was begun by Brunelleschi, the first great architect of the Renaissance, in 1441, and about a hundred years later was finished by Ammanati. The palace was built for Luca Pitti—one of the powerful fifteenth-century Florentines, a great tyrant who used his power as magistrate to force citizens to find money for his palace. When the family fell on evil times the house was sold to beautiful Eleonora, wife of Cosimo I, the Grand Duke, in 1549. Eleonora had the famous Boboli Garden made. Part of its lovely stretch faces the chief court of the Pitti, where the architect set up the classic columns.

THE WORK OF CENTURIES IN THE NOBLE PITTI PALACE

The world owes a great deal to the various men, patrons and architects and artists, who during the course of three hundred years worked to make the Pitti Palace one of the noblest places in the world. The building stands on rising ground, overlooking the city and the Arno, and round it, like a great girdle, is thrown the greenery of the garden. The additions that were made in the eighteenth century, after the Pitti had become the home of the reigning king, happily did not mar its beauty. Except for the Vatican, it is the largest palace in Italy.

The Pitti Palace is one of the buildings that one can call noble—most palaces are either grand or beautiful—and this nobility is due, not to its great size, but to its symmetry and perfect proportions, and the long sweep of its lines. Its weight is horizontal rather than vertical, and this strength is increased by the lines that emphasize the stories, and not lessened by one superfluous vertical line or ornament.

From the Pitti, which contains great

treasures of art, a gallery runs on to the Uffizi, once a palace, and now one of the finest art galleries of the world.

When we think of our own achievements, or the work of the last hundred years, we cannot help feeling that the world is passing through a barren period, architecturally speaking.

THE SPIRIT THAT IS MISSING IN THE WORLD TO-DAY

We have never been visited again by the fine spirit that created the Italian Renaissance. In those days a man made a hobby of something that nowadays would be a separate life-work. It was quite usual for an architect to be also a sculptor and a painter of note. The shining examples of this wealth of genius were, of course, Raphael and Michelangelo. But men who did not become so famous shared this richness and fullness of genius. The architect was naturally an artist of first quality. And, moreover, during this period the servants of architecture, the craftsmen, were persons of great gifts. The woodcarvers, goldsmiths, ironworkers, the kind of sculptors we should call now monumental masons, alone would have made the century memorable. At the end of the Renaissance the wave of golden energy ebbed away. Since then we feel that our best efforts have been only imitation.

Many architects were at work in Florence and the neighboring cities—men like Borgognone, Michelozzo, Filarete, Alberti, Alessi, Cronaca, and Brunelleschi, the most gifted of them all.

THE SPLENDID PALACES TOWERING ABOVE THE NARROW STREETS OF GENOA

The Renaissance helped to make Genoa, already marked by some fine churches of an earlier period, a most individual and distinguished-looking city. As in all the great Italian cities, the princes of commerce built palaces which displayed their beautiful lines high above her narrow streets. One of the most famous, now known as Municipio, was the Doria-Tursi Palace, built at the end of the sixteenth century. Earlier than that, Alessi was at work in Genoa, and to him more than anyone else is due the guiding of the taste of the citizens who were so willing and glad to make their town beautiful. Under Alessi's leadership the authorities reformed their famous street which is now called the Strada Garibaldi, and almost all the palaces that make it so picturesque are this architect's work. Others set up at a later date, like the Balbi and the Durazzo, owe much to Alessi.

One of the earliest town hospitals in Europe, the Ospedale Maggiore, rose in Milan during this period. In northern Italy most of the important works were buildings of a secular nature. Many churches and cathedrals, like those of Florence and Genoa, were altered and added to, and some new ones built. In Florence there was San Spirito and San Lorenzo and the Pazzi Chapel—one of Brunelleschi's most beautiful little buildings; and in Genoa Santa Maria in Carignano, the work of Alessi. The most important church of this group, historically speaking, is Sant' Andrea, Mantua, as it was the first to be built in the style that has been accepted as pure Renaissance.

THE TRIUMPHAL ARCH WHICH LEADS INTO A CHURCH

Sant' Andrea served as a model for many later buildings of a sacred character. The Roman arch was now being used by architects for the chief entrance of a church. A good example is San Francesco, Rimini, whose principal porch was to be a copy of the Arch of Severus. Unfortunately the façade was not finished. In Sant' Andrea, Mantua, the Roman triumphal arch forms a fine entrance.

One of the most interesting buildings of Europe is the Certosa at Pavia, the city where so many scholars found peace in the troubled years of northern Italy. The Certosa was planned in the fourteenth century by the chief lord of Pavia, who had determined to have "a palace wherein to dwell, a garden wherein to disport himself, and a chapel wherein to worship." It was begun in the Gothic years and finished in the Renaissance. A history of architecture and Italian beauty thus exists in this group, from the Gothic cloisters up to the strange-looking Renaissance storied tower set at the crossing in the church, and the marvelous gleaming front. This façade of marble, which has mellowed very beautifully, added to the Gothic church by Borgognone, is one of the triumphs of the early period of the Renaissance. A wealth of art was spent on the carved doors and on the interior decoration. One of the finest of the Certosa monuments is that to Ludovico Sforza and the lovely Beatrice d'Este, by Solari.

Northern Italy during the Renaissance

years was like a great forest where art-lovers could wander happily for years, finding ever new beauties, large and small.

The main growth of the movement reached perfection in Rome and Venice. Here the personalities of two architects dominated the work—first Bramante and then Michelangelo.

THE MASS OF TOWERS AND SPIRES IN A GOTHIC BUILDING

Bramante, who was born at Urbino in 1444, two years before the death of Brunelleschi, saw all the possibilities of the new style, and in his work we can see how he developed it. We can also see now at a glance the difference between a city which loved the Gothic style and one which loved Renaissance.

The sky-line of Gothic buildings was a mass of mounting spires and towers and pinnacles, every line in the masonry carried as high as it would go. The sky-line of Renaissance is a long horizontal bar, either a heavy cornice like that of the Riccardi Palace, for instance, or an open balustrade like that of the Capitol at Rome. The ceilings of Gothic buildings were a mass of intricate vaulting; in Renaissance we find horizontal ceilings, paneled and molded or simply arched. The tower of the Gothic church gave place in the Renaissance to a dome at the crossing. We can see this at once by comparing St. Paul's Cathedral with Westminster Abbey. Renaissance windows were very simple and much smaller than those of Gothic buildings. They were square-headed or round-headed; sometimes round-headed in a square frame—a feature which Bramante treated with great refinement; sometimes square-headed surmounted by a triangular pediment—a feature which has become very common in the so-called classical buildings of modern times.

THE PLACE OF THE PILLAR IN THE WORK OF THE RENAISSANCE

The use of the Orders, either as pillars or pilasters, which, we remember, are the fronts of pillars fastened to the wall as an ornament, became the strongest characteristic of Renaissance work. And the more the columns struck a simple vertical line, the more the courses of the stories and roof struck a powerful horizontal line. On the basis of this severe plainness a great deal of ornament was laid.

Bramante, his pupils and assistants, are responsible for a large number of buildings that rose toward the end of the fifteenth century and in the first half of the sixteenth century. His youthful training as an artist was under Mantegna, as an architect under Alberti. Bramante's early work is at Milan; there he built the churches of San Satiro and Santa Maria delle Grazie. Two very beautiful pieces of sacred architecture by Bramante are at Rome—the cloister, with its two-story arcade, of Santa Maria della Pace, and the tiny circular church, a miracle of taste and proportion, called the Tempietto, in St. Peter, Montorio.

Of Bramante's work on St. Peter's and the Vatican we shall be thinking presently. Apart from that his most famous secular buildings are the Cancelleria Palace and the Giraud Palace, Rome. Bramante's assistant, Sangallo the Younger, planned in 1534 what is probably the greatest house of sixteenth-century Renaissance—the Farnese Palace, Rome. Part of it was erected under Sangallo's supervision; Michelangelo added the third story ten years later. One of the chief beauties of the Farnese is its huge unbroken cornice, like those of the Florentine palaces.

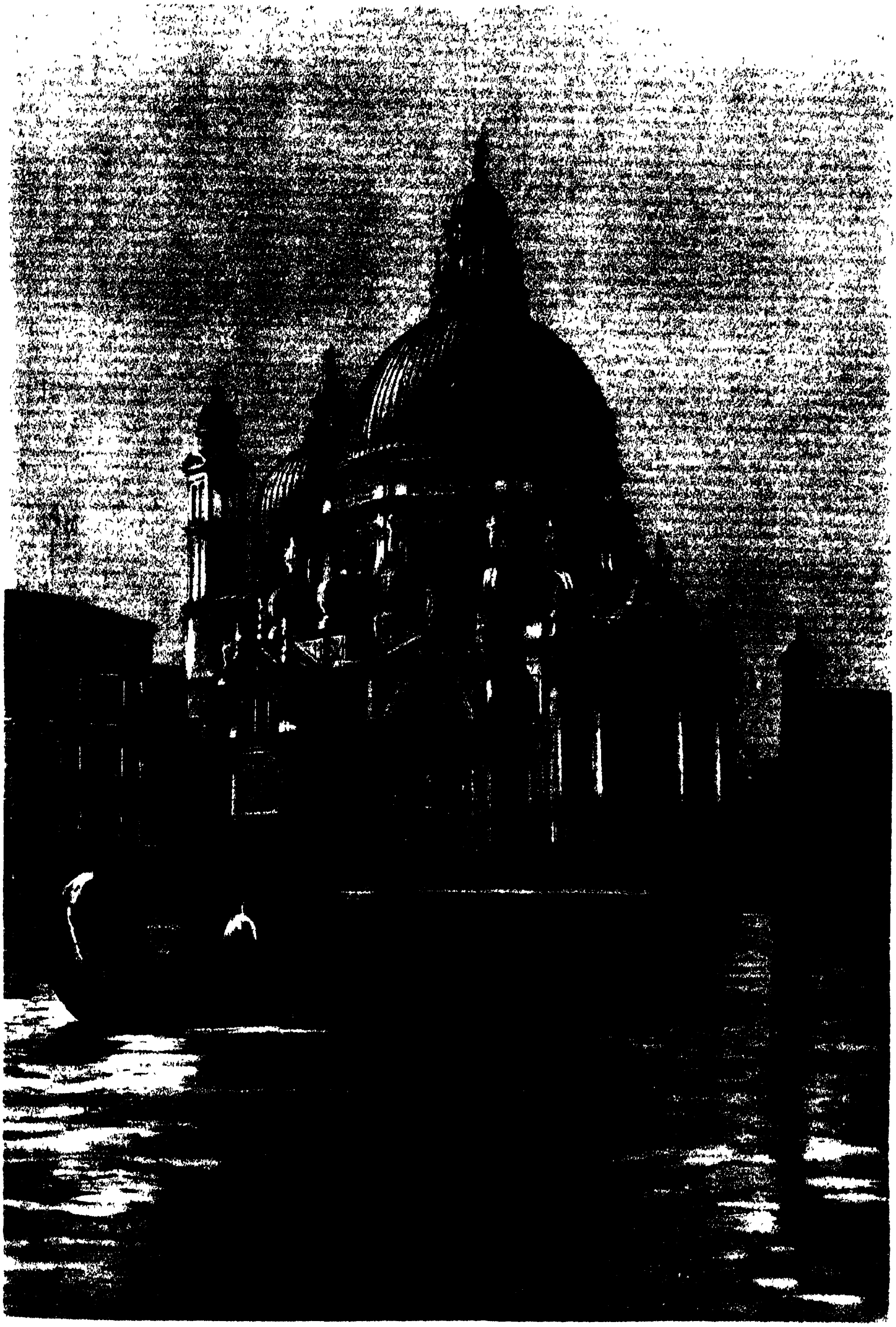
THE WORTHY STUDENTS WHO FOLLOWED A GREAT MASTER

The chief of Bramante's pupils and followers are Peruzzi and the great Raphael, Bramante's nephew. To these men the master handed on his scholarly tastes and his admirable restraint; most of the work they produced is worthy of the Bramante tradition. Peruzzi built, among other things, the Villa Farnesina, which Raphael helped him to adorn with frescoes. Raphael was responsible for certain parts of the Vatican, for the front of San Lorenzo, Miranda, and the Villa Madama, Rome, and the Pandolfini Palace, Florence, which was built after his death and is supposed to be his best architectural design. Raphael was also consulted about St. Peter's by the pope, but we do not find that he took any active part in the construction of the great church.

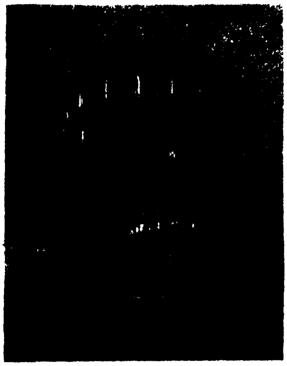
Giulio Romano, the painter, was one of Raphael's pupils and a builder as well. His finest piece of architecture is the Del Te Palace, Mantua, a wonderful one-story building. When it was set up Giulio had the delight of painting some of the frescoes himself.

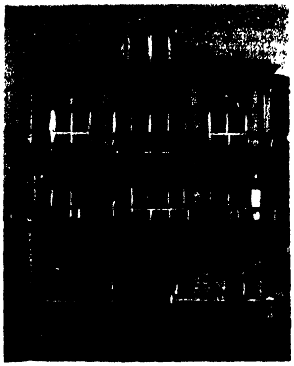
In the latter half of the sixteenth century some extremely interesting work

GREAT BUILDINGS OF ITALY

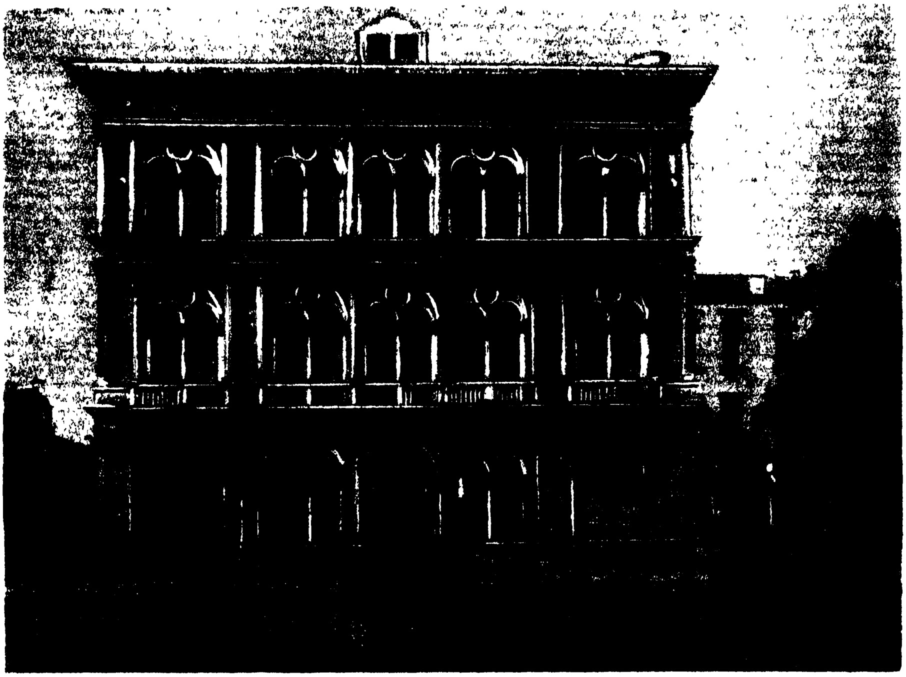


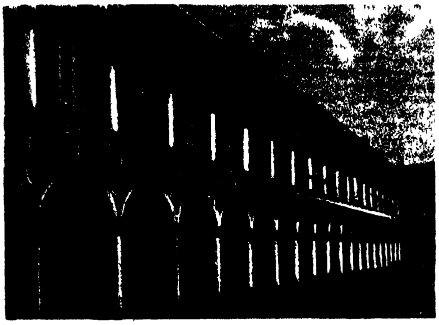
THE BEAUTIFUL CHURCH OF SANTA MARIA DELLA SALUTE ON THE BANKS OF THE GRAND CANAL IN VENICE

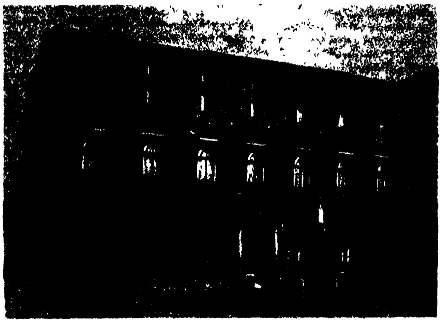

STA. MARIA DELLE GRAZIE, MILAN

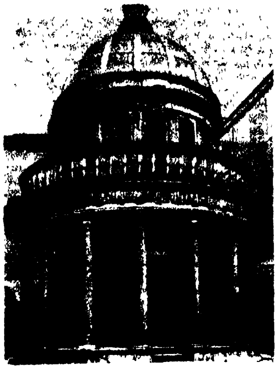

SPINELLI PALACE, VENICE

STA. MARIA DEI MIRACOLI, VENICE

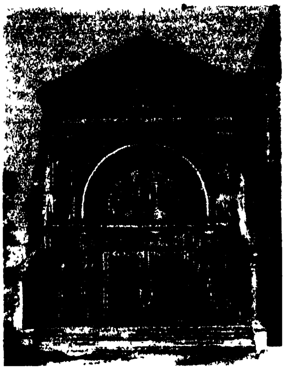

ONE OF THE SPLENDID PALACES ON THE GRAND CANAL IN VENICE


COURT OF THE MAGGIORE HOSPITAL IN MILAN


THE GIRAUD TORLONIA PALACE IN ROME

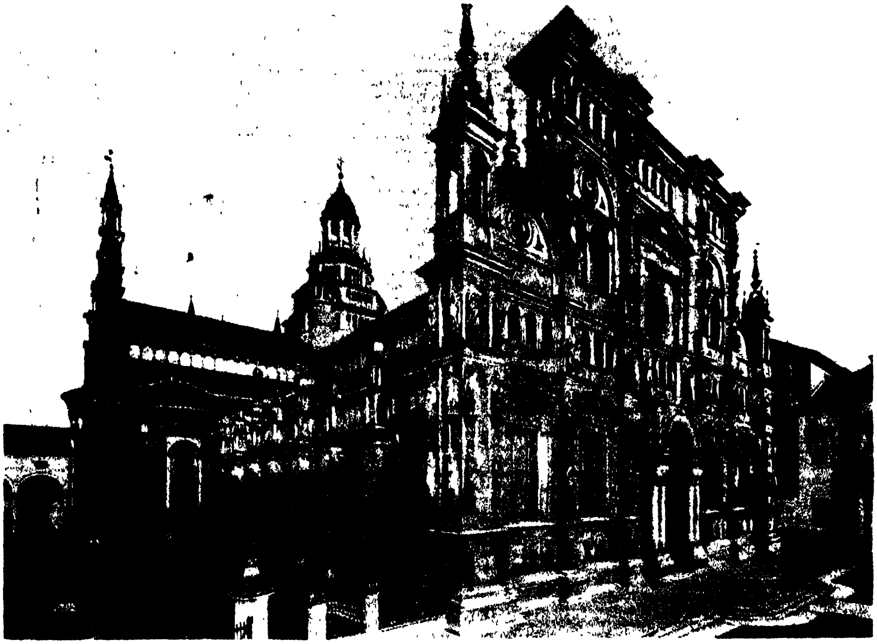


TEMPLE IN THE CHURCH OF ST. PETER MONTORIO, ROME



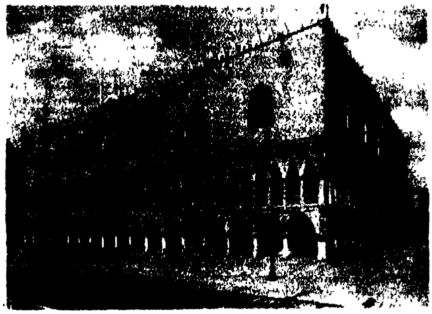
CHURCH OF SAN BERNARDINO, PERUGIA

THE FAMOUS MEDICI CHAPEL IN FLORENCE



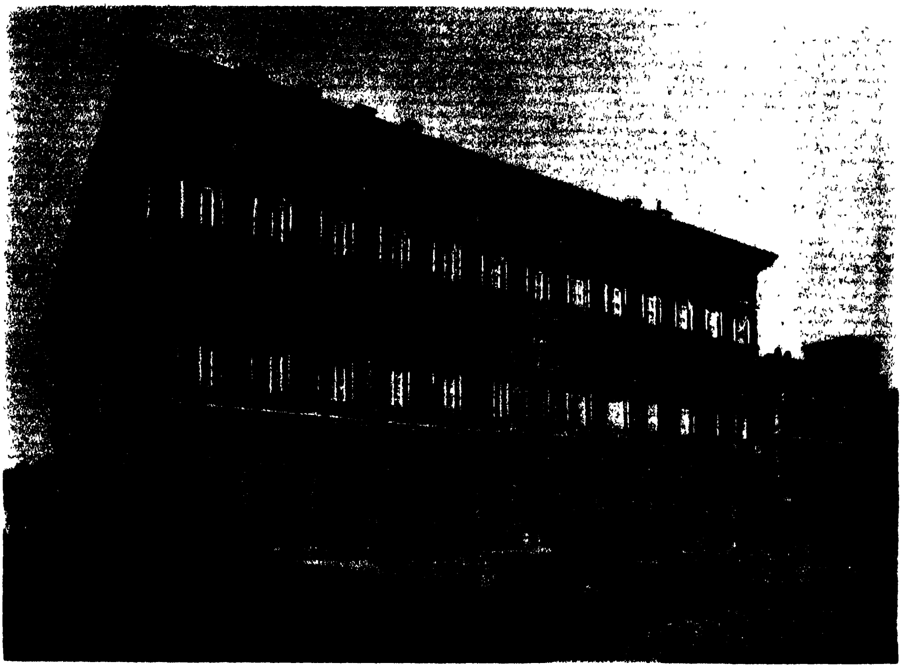
THE CERTOSA OF PAVIA, AN OLD CARTHUSIAN MONASTERY, NOW A NATIONAL MONUMENT

THE GUADAGNI PALACE IN FLORENCE

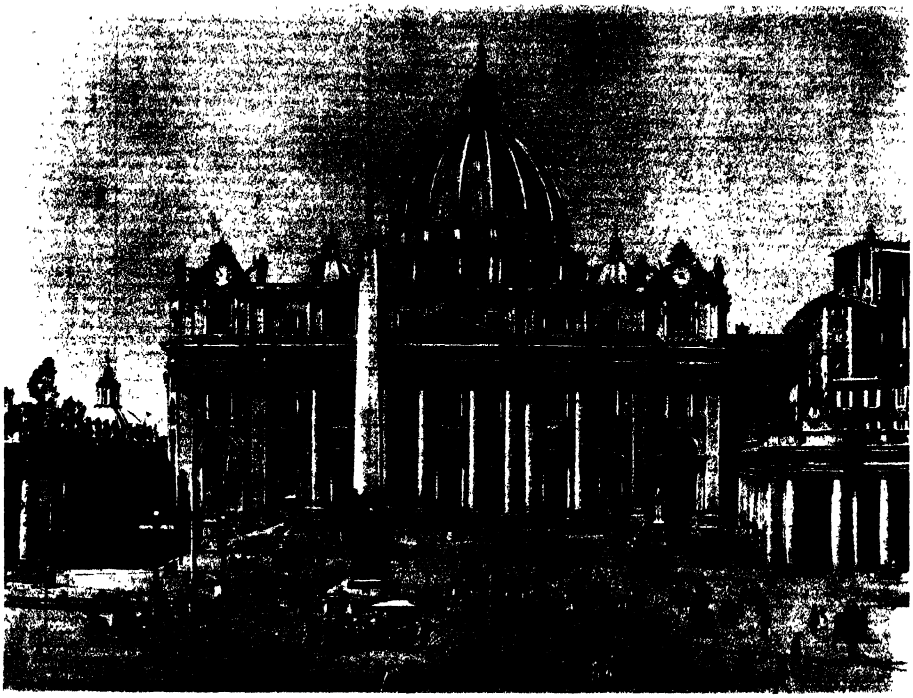


THE PALACE OF THE DOGES IN VENICE

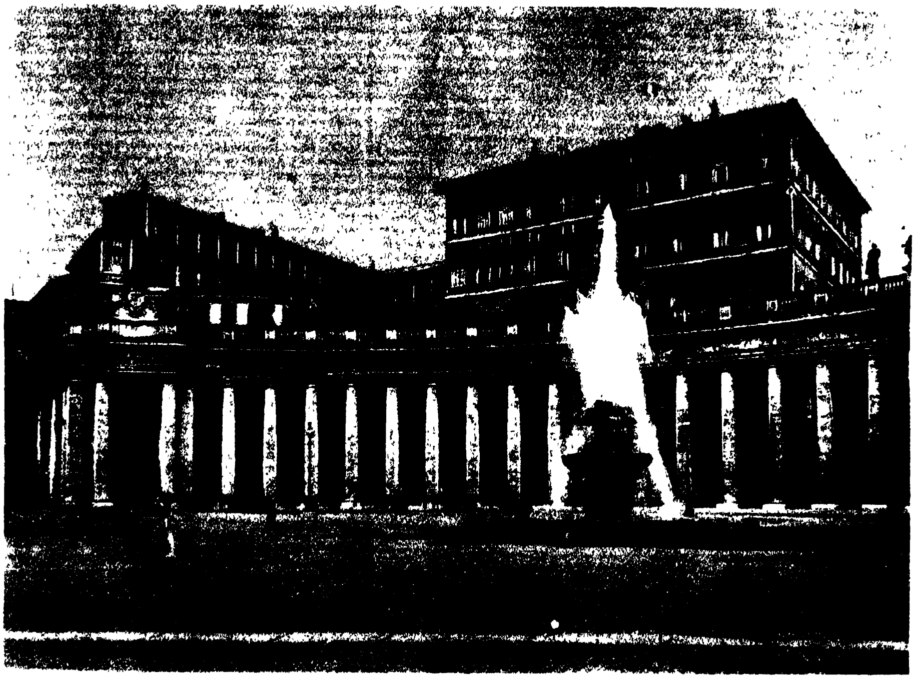
THE RIALTO BRIDGE ACROSS THE GRAND CANAL IN VENICE



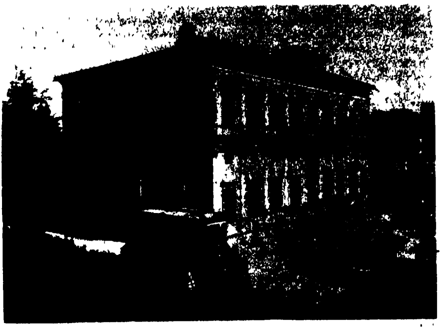
THE FARNESE PALACE IN ROME, WHICH MICHELANGELO HELPED TO BUILD



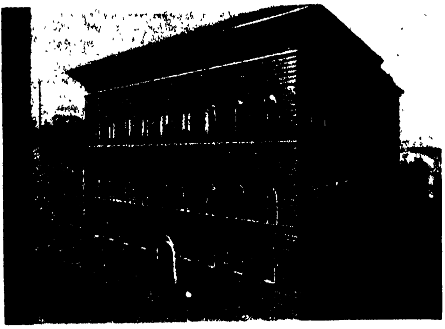
ST. PETER'S IN ROME—THE BIGGEST CHURCH IN THE WORLD



THE VATICAN IN ROME, SEEN FROM THE COLONNADED SQUARE IN FRONT OF ST. PETER'S



THE VILLA FARNESINA IN ROME

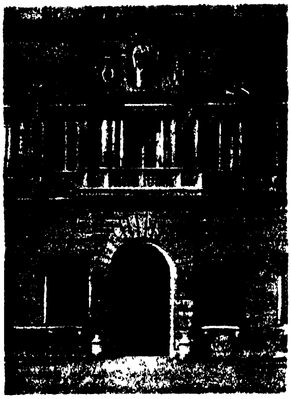


THE GREAT STROZZI PALACE IN FLORENCE

THE OLD TOWN HALL OF VERONA

A DOORWAY OF THE FARNESE PALACE, ROME

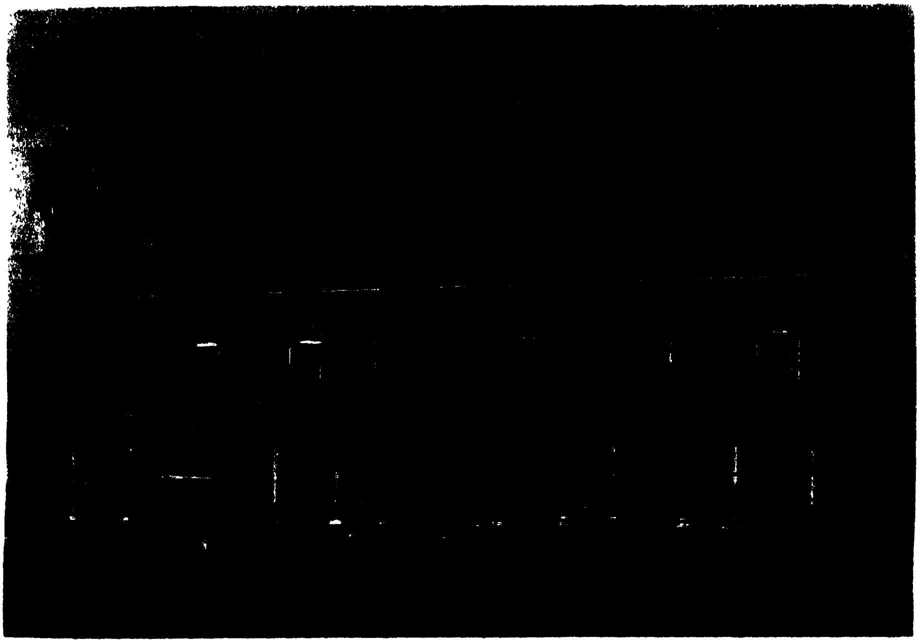
LOOKING UP INTO THE CUPOLA OF ST. PETER'S



A DOORWAY OF THE CERTOSA OF PAVIA

THE BASILICA PALLADIANA AT VICENZA

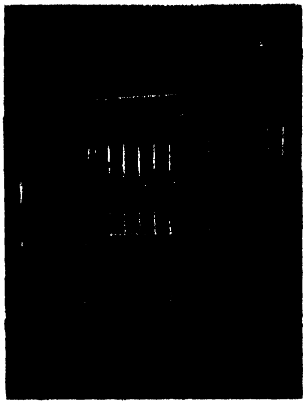
A PALACE ON THE GRAND CANAL IN VENICE



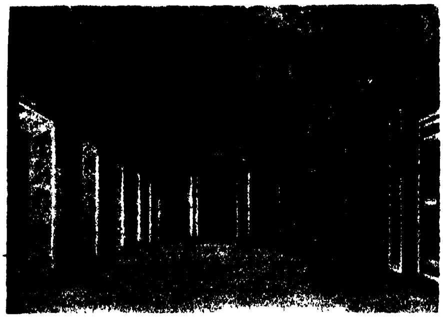
THE PALACE OF THE CONSERVATORI IN ROME

GRIMANI PALACE IN VENICE

A HALL IN THE VATICAN

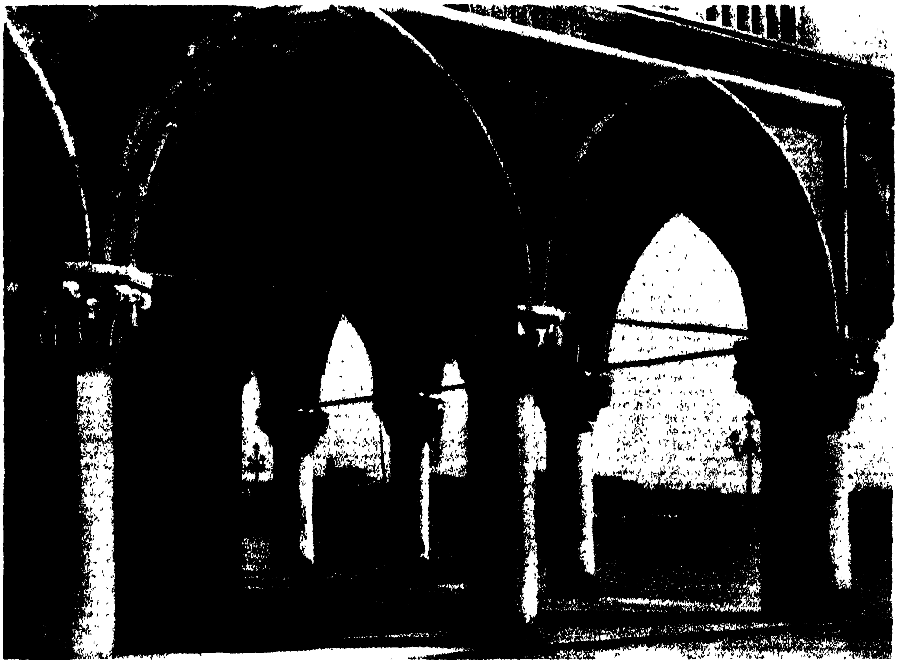


PISANI PALACE IN VENICE



A GALLERY IN THE RICCARDI PALACE
IN FLORENCE

THE BEAUTIFUL INTERIOR OF ST. PETER'S
IN ROME



THE ARCHES OF THE PALACE OF THE DOGES AT VENICE

A COURT IN THE RICCARDI PALACE, FLORENCE

A COURT IN THE FARNESE PALACE, ROME

was done by Barozzi da Vignola, who appears to have divided his time between Italy and France, and also found leisure to write a book which was important to students of that century, The Five Orders of Architecture. Among Vignola's chief buildings were the Church of Sant' Andrea and the Gesù Church, Rome, the Farnese Palace, Caprarola, and the Villa of Pope Julius, now the Etruscan Museum, Rome.

THE BIGGEST GROUP OF ARCHITECTURE IN THE WORLD

In the Vatican and St. Peter's all the grandeur of Roman art and history foregathered; with the Piazza they make the largest, most famous group of architecture in the world. The Vatican is called the Palace of the Popes, but the pope lives in only one corner of it.

This huge edifice was not set up in any one period: centuries have gone to its forming. The first bit of the Vatican, adjoining the ancient basilican church of St. Peter, was built at the end of the fifth century. About the year 1200 this fragment was reconstructed; the first additions were made by Pope Nicholas III eighty years later.

During the fourteenth century the popes made their home at Avignon, in southern France. They built a magnificent fortress-palace there, and sent for Italian painters to decorate the walls. In 1377 they returned to Rome, and at once it seemed an interest in art and architecture was aroused in the great city. Presently one of the popes caused a passage to be built on arches connecting the Vatican with the Castle of Sant' Angelo, whither during the terrible sack of Rome in 1527 Pope Clement was glad to flee.

HOW THE VATICAN GREW AND GREW THROUGHOUT THE AGES

Bit by bit the palace was added to, each ruler trying to leave his stamp on it. Pope Sixtus built the Sistine Chapel, of whose decorations we read on page 831; Alexander added the Borgia Tower. In the reign of Leo, and the warlike Julius who swung his sword, so to speak, through so many artists' lives, Bramante added his famous parts—the Court of St. Damaso and the Belvedere Court; and Raphael decorated his gallery and rooms. A later pope caused Sangallo, the architect, to add the Pauline Chapel and other apartments. After that the palace was widened, Bramante's courtyard being added to on the eastward side. Addition after addition came, courtyards and magnificent staircases and galleries, and at last the Vatican with a thousand rooms was finished. It is now a treasure-house of art, containing the largest collection of classic sculpture in the world.

In 1505 Pope Julius was taken with the idea of building a tomb-house for himself; from it grew the largest church in the world, St. Peter's, Rome. In order to clear the way Julius had the old basilican church pulled down (this had been built by Constantine in 330 near the place of St. Peter's martyrdom in Nero's circus) and then he invited all architects of note to compete for the work of the new building. The drawings and sketches made for this monument are now treasured in the Uffizi, Florence, and they show what a wealth of art there was in Italy in those days.

Bramante's design was the one chosen, and in 1506 the foundation-stone was laid. His plan was to build St. Peter's in the form of a Greek cross with a huge dome like that of the Pantheon, and a tower, in stages, of most beautiful work, at each of the four points of the cross.

THE ARCHITECTS WHO TRIED TO UPSET THE PLANS OF BRAMANTE

Seven years later Julius died, and his successor called in Sangallo, Fra Giocondo and Raphael, who naturally did not agree with Bramante, being architects themselves. The work of the first two was finished before they could alter much of the magnificent work Bramante had begun. Raphael suggested that the Greek cross should become a Latin cross, which, considering the proportions and general mass of the building, was a stupid suggestion. After Raphael's death Peruzzi was made the architect, and he liked the Greek cross formation. So, one way or another, the church grew.

Troubles within and without disturbed both the building and its advisers. The work had to stop for want of money; then war cast its shadow across the climbing walls; the sack of Rome, that seven months' horror, came. Peruzzi died in 1536, and Sangallo the Younger became architect to St. Peter's in his place. It seemed that no man could go on with the plan originally accepted; each had to make his mark in some way, and build, or try to build, a St. Peter's of his own. Sangallo proceeded to work according to his plan, but before he could finally spoil the building death in turn took him. And then on to this stage of many actors strode Michelangelo, genius and master.

The master was seventy-two, but not too old to fire guns. Slip-slap, to right and left, was shot the work of other men. Once more Bramante's plan of the Greek cross was reverted to, the two geniuses meeting on this point of taste. As such the church was carried on, but Michelangelo added his own treatment of chapel and apse. His work was vigorous and sane, and he began constructing the huge dome in the daring manner which has been the amazement of architects ever since.

THE ONE IDEA OF BRAMANTE WHICH NOW REMAINS IN ST. PETER'S

It is impossible to read the tale of the building of St. Peter's without wishing very sadly that either Bramante or Michelangelo could have finished it, or, at any rate, that after Bramante's death his very able plans might have been carried out. There is very little left now of the original exquisite and restrained design he made, save the idea of the dome. For in 1564 Vignola added cupolas in place of Bramante's towers, and Maderna, an architect of the early seventeenth century, for the last time opposed the Greek cross plan, pulled out the nave to make it in form a Latin cross, and added the chief front.

The last architect to set his mark on St. Peter's was Bernini. He built the magnificent entrance piazza, a great wide circular sweep, with its fourfold arcade of huge pillars. This fine empty space before the chief façade is of the most wonderful value, as it frames and sets back the great church. St. Peter's is an awe-inspiring sight, and fully half of the effect, to the approaching visitor standing by those immense pillars, is caused by the sweep of Bernini's piazza.

Everything about St. Peter's is huge. The dome is twice as high as the towers of Westminster. The pillars that run round the actual building are immense. The church's interior is almost oppressive in its magnificence.

THE MEN WHO COPIED THE STYLE OF MICHELANGELO

Michelangelo had done many other architectural works before he touched St. Peter's. His labors had been varied, from the staircase at the Biblioteca Laurenziana, Florence, which Vasari finished from his design, to the Medici Mausoleum. His greatest civic building was the Capitol at Rome. Another work of his in the great city was the turning of a Roman bath-house into the Church of Santa Maria degli Angeli.

After Michelangelo another change came over Renaissance architecture in Italy. The great genius had a number of followers who imitated his restless, tormented grandeur, and could not in their smallness get at the strength that underlay his style. In the seventeenth century architects began to have a horror of simple, classic lines, and they felt that the more curves a building had, the better it was. To this period, that of the degeneration of Renaissance style, which corresponds in architectural history with the last eccentricities of Gothic, the name of Baroque, or Rococo, has been given. It is, as we may guess, not a good architecture. But in spite of its real weaknesses some interesting Baroque work was produced in Venice and the neighboring cities.

THE GLORY OF VENICE IN THE FIFTEENTH AND SIXTEENTH CENTURIES

In Venice, the fairy city set in the sea, palaces of dazzling beauty mark the Renaissance period. Like Florence, Venice was an independent power and had much wealth which she joyfully expended in the interests of art and architecture. Palaces arose in the Gothic and Renaissance period as a matter of course, just as nowadays in a thriving American city huge stores would appear. The standard of the Venetian was high; nothing paltry or cheap was allowed to appear; we can scarcely conceive of the glory of fifteenth- and sixteenth-century Venice.

The city had, of course, a charm of her own, which, apart from the strong, individual taste of the Venetians, gave distinction to her architecture. No other Italian palaces were lapped by tides which flung up an added radiance into the sun's light and drew down the lines of walls and doors in long, wavering reflections, and painted them in the richness of color that tranquil water alone can give.

It was because sky and sea made such a glory of the marble lines that Venetian architecture in the years of wealth became so decorative. Surface ornament was peculiarly rich in the Baroque period—too rich. Balconies flung out their traceries against gleaming walls; cornices running the length of stories cast bands of blue shadow aslant the palace fronts.

We have already noted, in mentioning San Marco, how independent was the Venetian spirit. When Renaissance architecture rose in the city her artists and architects created not only this rich surface effect, but a design for grouping their windows which is very pleasant and sets them apart from other Italian palaces of the period. They placed a cluster of windows in the middle of a façade, with bare wall on either side making the group appear the richer by contrast.

THE LOVELY CITY THAT STANDS ON A NETWORK OF CANALS

To go along the Grand Canal, which is the main street of Venice, almost lined with palaces, and across the wonderful Rialto Bridge, is to receive an unforgettable impression of Venetian genius.

As in other Italian towns, it was often difficult to decide whether a Venetian's work entitled him more to the description of architect than sculptor. The two arts almost always went together; many men have laid the stamp of their dual gifts on Venice. In the sixteenth century two great names stand out—the gifted Lombardi family and Jacopo Tatti, generally known as Sansovino. To Pietro Lombardo is due, among other notable works, the lovely marble Church of Santa Maria dei Miracoli, one of the most exquisite things the Renaissance produced in Venice. To Sansovino, again among other notable works, the city owes the Library of San Marco, the greatest civic building produced in Italy in this period. The School of San Marco, now a hospital, was built by one of the younger Lombardi.

Many architects were concerned in the most famous house in Venice, the Palace of the Dukes, or Doges. Like the Vatican, it took centuries to grow. It was begun early in the ninth century, was twice burned down and rebuilt, and suffered many alterations. The façades date from the Gothic period (Bartolommeo Buon was responsible for some of their early beauty), and each successive generation added something. The great courtyard with its arcade is one of the most delightful things in Italy, and is unique in the architecture of the period.

The palace is built of various kinds of marble. In places rose and white blocks make a pattern of color which, added to the open tracery and richly carved columns, creates an exquisite effect. In due course Pietro Lombardo was employed on the palace, and after him Bergamasco, and, later, Scarpagnino, another architect. From the courtyard rises the famous Giant's Staircase, and here Sansovino, working in the capacity of sculptor this time, placed the fine figures of Mars and Neptune. Paul Veronese and Tintoretto painted some of the walls and ceilings of this famous palace, whose doorways and chimney-pieces are wonderfully carved. At every third step, it seems, one is confronted by a great work of art. The Bridge of Sighs, its gleaming shape hung over the waterway, connects the palace with the prison.

The last great architect of the later Renaissance was Andrea Palladio, a man of great gifts who has had a considerable effect on Europe. Some of his works were carried out in Vicenza; many others were begun, but did not reach completion.

THE FINE THINGS PALLADIO MADE FROM HIS POOR MATERIAL

Palladio had often to build in poor material, such as brick faced with stucco, and it was a mark of genius that out of such commonplace material he should have created works of art. He published a famous work on architecture which contained a history and description of buildings since destroyed, and also designs for his own buildings.

Palladio built many palaces in Vicenza, and added the famous arcades to the old basilica in that town. One of his best-known works was the Redentore Church, Venice.

Soon after Palladio's death buildings in the Baroque style began to be seen. Probably the most famous of all Baroque buildings is the Santa Maria della Salute Church in Venice, built by Longhena. Bernini, whose piazza for St. Peter's we have already mentioned, was a Baroque architect, one of many who labored in Italy, not altogether for its good, in the seventeenth century.

All countries and races have to pay the price of a great period in art by the poor work which inevitably follows it. And perhaps we can appreciate pure Renaissance buildings in Italy all the better because we are obliged to pass by so much that is unworthy of them.

THE NEXT STORY OF THE FINE ARTS IS ON PAGE 6489.

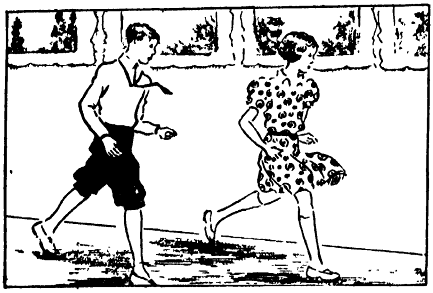
FRENCH—*A Visit to the Louvre*

First line, French; second line, English word; third line, as we say it in English.

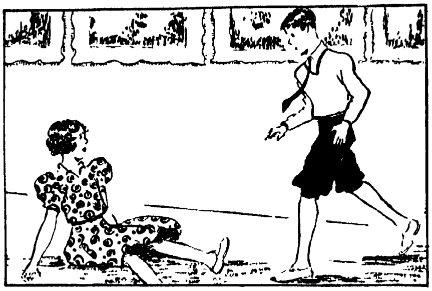
Jeannette elle est malade. C'est tout à fait ma faute. Cela me fait de la peine.
Jenny she is ill. This is entirely my fault. That me makes of the sorrow.
Jenny is ill. It is all my fault. I am very sorry.

Hier maman nous a conduits au Louvre pour voir les tableaux.
Yesterday Mamma us has conducted to the Louvre for to see the pictures.
Yesterday Mamma took us to the Louvre to see the pictures.

Les galeries sont très longues et glissantes. C'est bien la place pour glisser.
The galleries are very long and slippery. This is very the place for to slide.
The galleries are very long and slippery. It is just the place for sliding.



Nous glissons—We slide.



Jeannette tombe—Jenny falls.

Jeannette et moi, nous avons glissé d'un bout à l'autre de la salle.
Jenny and I we have slid from one end to the other of the room.
Jenny and I slid from one end of the room to the other.

Maman a crié: "Prenez garde!" Il était trop tard. Jeannette était tombée.
Mamma has cried: "Take care!" It was too late. Jenny was fallen.
Mamma cried: "Take care!" It was too late. Jenny had fallen.

Elle n'a pas pu se relever. Elle a crié: "Ma jambe! Ma jambe!"
She(not)has not been able herself to raise. She has cried: "My leg! My leg!"
She could not get up. She cried: "My leg! My leg!"

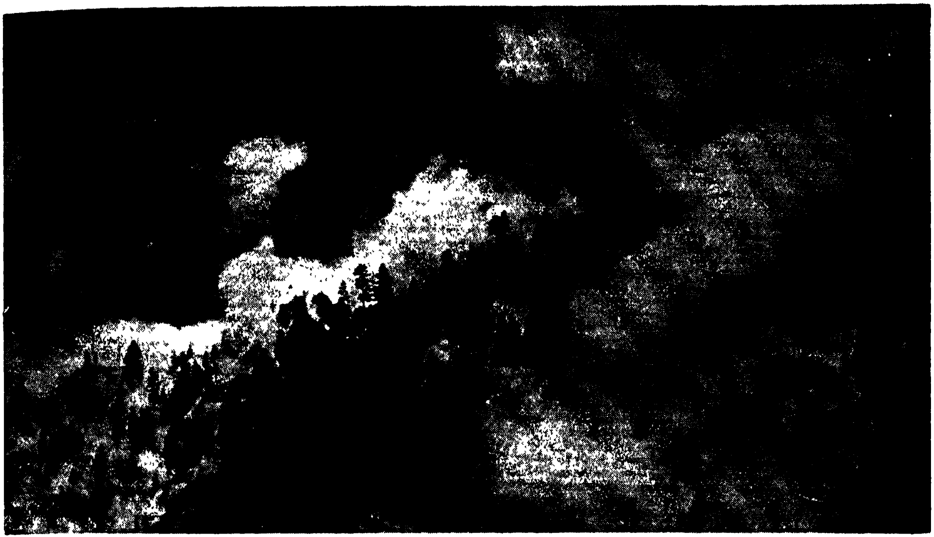
Un monsieur a dit à maman: "La petite fille s'est-elle fait mal?"
A gentleman has said to Mamma: "The little girl herself is she made ill?"
A gentleman said to Mamma: "Has the little girl hurt herself?"

"Je crains que la jambe ne soit cassée." Le monsieur a examiné la jambe.
"I fear that the leg not be broken." The gentleman has examined the leg.
"I am afraid that her leg is broken." The gentleman examined the leg.

"Elle s'est foulé le pied. Elle ne doit pas marcher pendant quelque temps."
"She herself is sprained the foot. She(not)must not to walk during some time."
"She has sprained her foot. She must not walk for some time."

Nous l'avons mise dans un taxi, et nous sommes rentrés à l'hotel.
We her have put into a taxi, and we are returned to the hotel.
We put her into a taxi and returned to the hotel.

THE NEXT FRENCH STORY IS ON PAGE 6374.



Courtesy, U.S. Weather Bureau

A forest fire is a quick chemical change. The decay of trees produces just as much heat, but it takes more time.

CHEMISTRY *and* TEMPERATURE

A GREAT branch of modern industry is concerned with making substances chemically. Dyes; fertilizers; explosives; drugs that save our lives when we suffer from diseases that used to be fatal; nylon and rayon and aralac, that help to clothe us; plastics for phonograph records and luggage, clock cases and hairbrushes and a thousand other articles; steel that resists rust; silicone rubber that remains flexible at extremes of heat and cold at which natural rubber would become brittle or melt; Pyrex glass that may be heated red-hot and plunged into cold water without breaking—these are only a few examples of the products of chemistry. We come to think of chemistry as the science of making new materials. Yet about half of our chemical industries are more concerned with the *energy*—light, heat, electricity and motion—that results from chemical changes than with the substances formed during those changes.

Some chemical reactions are accompanied by a great deal more heat than others. Some even take heat from the surroundings. Many chemical changes result in high temperatures, others do not. What decides the amount of heat that is given off or the heat that is absorbed during a chemical change?

The amount of heat depends on the following points:

1. How much of a substance is used. Two pounds of coal in a furnace give twice as much heat as one pound; 2,000 cubic feet of illuminating gas give twice as much heat as 1,000 cubic feet of the same gas.

2. What kind of a substance is used. A pound of petroleum, when it burns, produces about one and a half times as much heat as a pound of coal; while a pound of hydrogen, when it burns, produces about two and a half times as much as petroleum. (Burning in all these cases means combining with oxygen.) The combining of half an ounce of carbon with oxygen to form carbon dioxide produces enough heat to raise two pounds of water—almost a milk bottle full—from 0°C.—the temperature of ice, to 100°C.—water's boiling point. The combining of half an ounce of nitrogen with oxygen, to form the gas nitric oxide, *uses up* an equal amount of heat.

We have seen that the amount of heat produced in a chemical change depends on the substances used and their quantities. The same amount of heat is obtained whether the change occurs quickly and in a small place, or slowly and in a large place. If the change occurs quickly and the heat produced is confined, much more heat will be concentrated at a given spot—the temperature will be higher.

When trees decay, heat is produced. A sensitive thermometer held near decaying wood shows a very slight rise in temperature. Yet, what a conflagration and what high temperatures result from a forest fire! The same number of trees, decaying over many, many years, produce the same amount of heat as the forest fire. The difference in temperature is due to the speed of the conflagration and the inability of the forest-fire heat to be quickly spread over a large area.

SOME OF THE REASONS WHY A CHEMICAL CHANGE MAY MOVE QUICKLY

Let us now consider a number of conditions that may make a chemical change move quickly, with resulting high temperatures.

1. Large surface exposed to reaction. A lump of coal raised to the proper starting temperature—its kindling point—and supplied with sufficient air will gradually burn away. The same lump of coal broken up into a fine dust and mixed with air will be easily ignited by a spark and will burn up in a flash with explosive violence and a very high temperature. Explosions in coal mines, flour mills and in sugar factories may result from the rapid burning of these dusts.

The rapid burning of mixtures of certain gases with explosive violence is due to the fact that gases are in the finest possible state of division—they are composed of molecules much too small to see. A lump of coke burns more rapidly and can give a higher temperature than coal because coke is porous; and, as finely divided particles do, it offers more surface for contact with oxygen. More coke, therefore, can burn up at any given moment.

2. An intimate mixture—mixing together well the reacting substances. Finely divided lycopodium powder lying in a heap will burn very slowly if ignited by a match. When the powder is thrown into the air and allowed to mix with the air, it goes up in a flash when touched by a match.

3. Correct proportions. Hydrogen and oxygen combine most rapidly when for every volume, or measure, of oxygen, two volumes of hydrogen are used. If three volumes of hydrogen, for instance, were used, the extra hydrogen would only act as an interference. It would slow down the burning, and would be left over after the burning.

4. Concentrating—crowding together—the materials. A candle burns more rapidly in pure oxygen than in air. The oxygen in the air is spread out; so, fewer oxygen molecules touch the wick at any given moment than when the candle is surrounded by pure oxygen. (The material of the candle rises into the wick, vaporizes, and burns by combining with the oxygen.) The nitrogen and other gases in the air also interfere, since they make it more difficult for oxygen molecules to come in contact with the wick. Torches burn badly at high altitudes, because the oxygen becomes thinner as we ascend.

5. The use of catalytic agents. Catalytic agents are substances which either speed up or slow down a chemical reaction. They themselves are found unchanged at the end of the reaction. A solution of hydrogen peroxide gradually decomposes at ordinary temperatures, that is, some of the oxygen goes off into the air, leaving behind H_2O, plain water. If some manganese dioxide—a black powder—is put into this solution, the action is speeded up.

6. Putting materials into solution. In the case of acids, bases and salts, no action at all occurs when the dry substances are brought together. When the substances are dissolved in water, the action is instantaneous. The water is left unchanged. Baking powder must be kept dry for this reason, or it will be spoiled.

HEAT MAKES THE MOLECULES OF A SUBSTANCE MOVE FASTER, SPEEDING UP THE REACTION

7. Raising the temperature. For every rise of 10°C. the speed of a chemical change is at least doubled. A rise of 100°C. will, therefore, change the speed at least 1,000 times. A mixture of hydrogen and oxygen kept at room temperature shows no sign of union. At 300°C. a small part of the mixture changes in the space of several days. At 500°C. a large part reacts in several hours. At 700°C. the entire mixture reacts almost instantaneously. This marked effect of temperature is only partly explained by the fact that heat makes molecules move more rapidly. Faster-moving molecules meet more frequently and so have a better chance to react. The vast increase in the speed of the reaction can not, however, be accounted for by the mere increase in the number of collisions. Something else must happen. It is believed that certain molecules are somehow especially "activated." They perhaps gain very great speeds as compared to the

speed of other molecules present at that temperature; or they may have the arrangement of their electrons disturbed. This marked "activation" results in their combining with other molecules which they meet. The product of the combination may, in turn, be an "activated" particle, and so a chain of reaction develops.

For highest temperatures, then, we need materials that have a high heat of reaction—certain quantities of these materials produce more heat than equal quantities of other materials. In the oxy-hydrogen blowpipe, the gases oxygen and hydrogen are so mixed as to give a temperature of 2500°C. in a closed place. At this temperature platinum melts and a heavy steel plate is cut in two in several minutes. A higher temperature can be obtained by using acetylene instead of hydrogen. We also need favoring conditions to obtain the highest temperatures.

EXTREMELY HIGH TEMPERATURES ARE PRODUCED IN THE THERMIT WELDING PROCESS

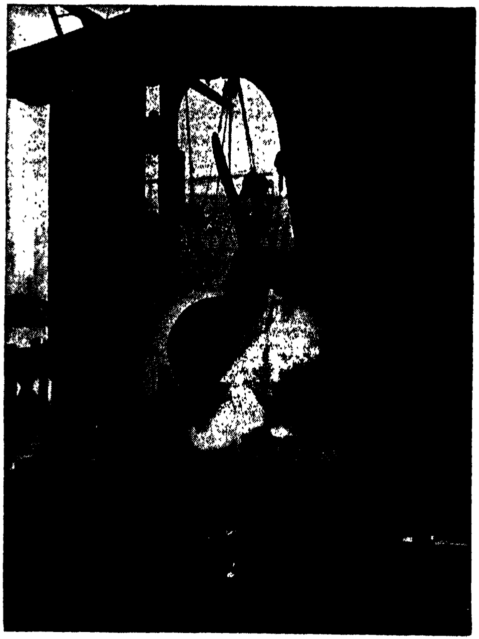
One chemical change which uses an intimate mixture of fine powder is the Thermit reaction, or Thermit process. Aluminum powder is mixed with iron oxide and is set off by means of an ignition powder. The reaction yields a temperature as high as 3500° C. The Thermit process is used to weld broken rails. The broken ends of the rails are first heated by a gasoline torch. Then the molten iron produced in the Thermit reaction flows into the joint.

We have up to this point discussed changes in which heat is liberated. Now, there are chemical changes which do just the opposite. When the red powder mercuric oxide is heated to get mercury and oxygen, heat must be constantly applied. The reaction can not be started at a certain temperature and then allowed to run by itself, as paper does when the match which started it burning is removed. With mercuric oxide, as soon as the heat is removed, the change stops. Now, neither the test tube in which the heating is carried out nor the surrounding air gets as hot as one might expect from the heat used up. Heat somehow seems to disappear. We say the reaction is endothermic.

When the mercury and oxygen are made to combine again to make mercuric oxide, the same amount of heat which seemed to disappear before is now liberated. We say the reaction is exothermic. This is but one illustration of the law which states that the quantity of heat required to decompose a compound into its elements equals the quantity of heat evolved when the compound is formed from its elements. Compounds which are formed from very active elements—elements that combine easily with the liberation of a great deal of heat—are very difficult to decompose. Magnesium combines with oxygen very readily. You can observe this in a photographer's flash bulb. Much heat and light result. The compound formed, magnesium oxide, can not be decomposed even at the very high temperatures obtained in an electric furnace.

Water formed from hydrogen and oxygen decomposes satisfactorily only at 3800° C. Yet here is a curious fact. What can be accomplished by heat only with great difficulty can often be accomplished by an electric current rather easily. Water can very easily be decomposed by the electric current.

Compounds, however, which were formed with the *absorption* of much heat are unstable. They are easily decomposed. They tend to explode. Many high explosives are nitrogen compounds. The names TNT (trinitro-toluene) and nitroglycerin and ammonium nitrate are, as their names inform us, nitrogen compounds. Nitrogen combines with oxygen with great difficulty at very high temperatures and the action is endothermic—much heat is absorbed. These unstable



Courtesy, Metal & Thermit Corporation

Repairing a large ship by means of the Thermit process. Temperatures as high as 3500° C. are produced.

compounds decompose rather easily and quickly, and in doing so give off much heat.

A large number of molecules of simple gases result from the decomposition of these explosives. The great heat of the decomposition makes these molecules move very rapidly; and the gases seek to occupy very large volumes as compared to the original solid. It is this rushing of heated gases that makes the push and blast of an explosion.

So then, heat energy may result from elements combining to form compounds, or, in some cases, from the compounds decomposing.

Now, what is a hot substance?

Scientists believe that a hot substance is one in which molecules are in rapid vibratory motion. The molecules in a hot iron, for instance, are, on the average, vibrating (moving to and fro) with greater speed than in an iron kept at room temperature.

What, then, is cold? Cold is the absence of heat, a lack of rapid vibrations of molecules.

When liquid mercury is surrounded by dry ice, the motion of its molecules becomes slower and slower as it gets colder and colder, until a solid piece of mercury is formed.

It is believed that the lowest possible temperature is —273°C. We call that temperature absolute zero. At absolute zero there would be no vibrations of molecules.

Let us consider the effect of cold on some common things.

A piece of tin may easily be melted in a crucible held over the flame of a gas range. If the hot molten tin is put into a cold place, like a refrigerator, it finally becomes solid again.

COLD IS A CONDITION OF LOW TEMPERATURE IN WHICH MANY STRANGE THINGS OCCUR

What happens in the cold? Heat is transferred from the hot tin to the cold refrigerator until the two temperatures are equalized. The molecules of the tin, which in melting vibrate more rapidly and move farther apart, now, on cooling, come closer together again as their motion slows down.

Curious things happen at the low temperature of liquid air. A rubber ball becomes so brittle that it is smashed into pieces like glass when thrown down; a lead bell rings; and a candle can be made of kerosene.

What is hot and what is cold are relative. Liquid air boils on a cake of ice. The ice is so hot compared to the liquid air that it heats the air.

The various effects of cold just mentioned are not called chemical changes, because no new substances are produced. Of course, they are often important, as for example, the brittleness of rubber in high-altitude flying.

As far as chemical reactions are concerned, cooling—lowering the temperature—slows the process, except in rare cases.

The hydrogen-arc welding torch is an interesting example of heat production. Here we find hydrogen molecules separated into atoms at the high temperatures of the arc. This separation is highly endothermic—much heat is absorbed. When the atoms afterward combine with oxygen, there is a twofold giving off of heat. The amount of heat freed is equal to that usually liberated when oxygen and hydrogen combine; and the extra heat that the atoms had absorbed from the arc is also given off. The result is a very high temperature. Metals that can not be welded by other means are welded by this atomic hydrogen torch.

BY SHATTERING AN ATOM WE ARE ABLE TO RELEASE GREAT QUANTITIES OF ENERGY

Lastly, we come to the tremendous temperatures possible by splitting the nucleus (center) of an atom, by releasing the energy stored in that nucleus, and by converting, perhaps, the very protons and neutrons in the nucleus into energy.

When a neutron strikes a particular kind of uranium atom called U-235 at a certain speed, the uranium nucleus splits. A certain amount of energy which held the core of the atom together is released. Several neutrons fly off. Some of them may then strike other atoms. In this way a chain-reaction may be set up and a number of atoms may be divided and their binding energy released. It is estimated that the splitting of all the atoms in *one pound* of U-235 would release the same amount of energy as the burning of 1,250 tons of coal or the decomposition of 10,000 tons of TNT. It is estimated that in splitting the uranium nucleus, we destroy about 1/1000 of the "weight" or "mass"; and in return we have some form of energy, such as heat. If now we could destroy the entire mass—change all the protons and neutrons and electrons into energy—we should get about 1,000 times as much energy from the atom. A pound of uranium could then give us the energy of about 1,250 x 1,000 or 1,250,000 tons of burning coal. Indeed, it is believed that a pound of any substance could give that amount of energy.

By MORRIS MONDZAK.

THE NEXT STORY OF SCIENCE IS ON PAGE 6388.

A DISSERTATION UPON ROAST PIG

By Charles Lamb

Illustrated by Kurt Wiese

Mankind, says a Chinese manuscript, which my friend M. was obliging enough to read and explain to me, for the first seventy thousand ages ate their meat raw, clawing or biting it from the living animal, just as they do in Abyssinia to this day. This period is obscurely hinted at by their great Confucius in the second chapter of his "Mundane Mutations," where he designates a kind of golden age by the term Chofang, literally the Cooks' Holiday.

The manuscript goes on to say that the art of roasting, or rather broiling (which I take to be the elder brother), was accidentally discovered in the manner following: The swineherd, Ho-tĭ having gone out into the woods one morning, as his manner was, to collect mast for his hogs, left his cottage in the care of his eldest son, Bo-bo, a great lubberly boy, who, being fond of playing with fire, as younkers of his age commonly are, let some sparks escape into a bundle of straw, which, kindling, quickly spread the conflagration over every part of their poor mansion, till it was reduced to ashes.

Together with the cottage (a sorry antediluvian makeshift of a building you may think it), what was of much more importance, a fine litter of new-farrowed pigs, no less than nine in number, perished. China pigs have been esteemed a luxury all over the East, from the remotest periods that we read of. Bo-bo was in the utmost consternation, as you may think, not so much for the sake of the tenement, which his father and he could easily build up again with a few dry branches and the labor of an hour or two at any time, as for the loss of the pigs.

While he was thinking what he should say to his father, and wringing his hands over the smoking remnants of one of those untimely sufferers, an odor assailed his nostrils, unlike any scent which he had before experienced. What could it proceed from? Not from the burnt cottage. He had smelt that smell before; indeed, this was by no means the first accident of the kind which had occurred through the negligence of this unlucky young firebrand. Much less did it resemble that of any known herb, weed, or flower. A premonitory moistening at the same time overflowed his nether lip. He knew not what to think. He next stooped down to feel the pig, if there were any signs of life in it. He burnt his fingers, and to cool them applied them in his booby fashion to his mouth. Some of the crumbs of the scorched skin had come away with his fingers, and for the first time in his

It was the pig that smelt so, and the pig that tasted so delicious! Greedily, Bo-bo started to devour the rest of the pig.

life (in the world's life, indeed, for before him no man had known it) he tasted— *crackling!* Again he felt and fumbled at the pig. It did not burn him so much now, still he licked his fingers from a sort of habit. The truth at length broke into his slow understanding, that it was the pig that smelt so, and the pig that tasted so delicious; and surrendering himself up to the newborn pleasure, he fell to tearing up whole handfuls of the scorched skin with the flesh next it, and was cramming it down his throat in his beastly fashion, when his sire entered amid the smoking rafters, armed with retributory cudgel, and finding how affairs stood, began to rain blows upon the young rogue's shoulders, as thick as hailstones, which Bo-bo heeded not any more than if they had been flies. The tickling pleasure which he experienced in his lower regions had rendered him quite callous to any inconveniences he might feel in those remote quarters. His father might lay on, but he could not beat him from his pig, till he had fairly made an end of it, when, becoming a little more sensible of his situation, something like the following dialogue ensued:

"You graceless whelp, what have you got there devouring? Is it not enough that you have burnt me down three houses with your dog's tricks, and be hanged to you! but you must be eating fire, and I know not what—what have you got there, I say?"

"O father, the pig, the pig! do come and taste how nice the burnt pig eats."

The ears of Ho-ti tingled with horror. He cursed his son, and he cursed himself that ever he should beget a son that should eat burnt pig.

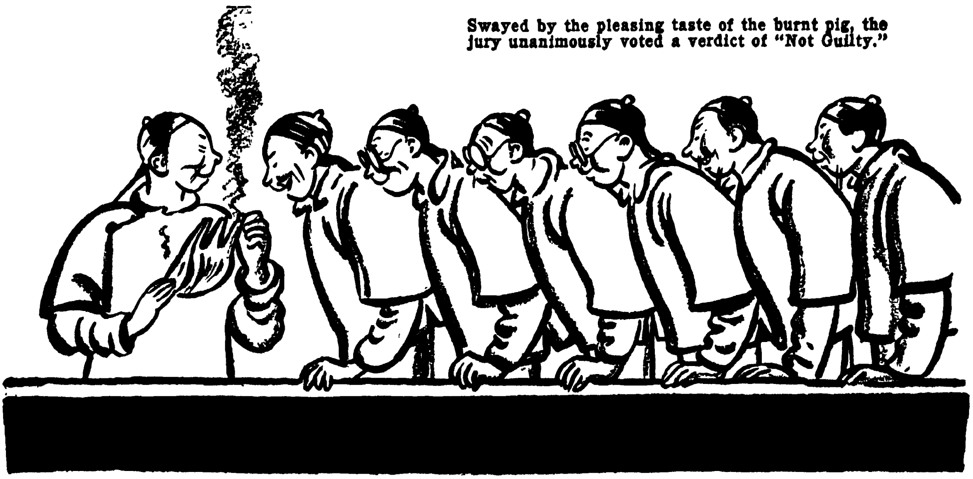
Bo-bo, whose scent was wonderfully sharpened since morning, soon raked out another pig, and fairly rendering it asunder, thrust the lesser half by main force into the fists of Ho-ti, still shouting out, "Eat, eat, eat the burnt pig, father, only taste—O Lord!"—with such like barbarous ejaculations, cramming all the while as if he would choke.

Ho-ti trembled in every joint while he grasped the abominable thing, wavering whether he should not put his son to death for an unnatural young monster, when the crackling scorching his fingers, as it had done his son's, and applying the same remedy to them, he in his turn tasted some of its flavor, which, make what sour mouths he would for a pretense, proved not altogether displeasing to him. In conclusion (for the manuscript here is a little tedious) both father and son fairly sat down to the mess and never left off till they had dispatched all that remained of the litter.

Bo-bo was strictly enjoined not to let the secret escape, for the neighbors would certainly have stoned them for a couple of abominable wretches, who could think of improving upon the good meat which God had sent them.

Nevertheless, strange stories got about. It was observed that Ho-ti's cottage was burnt down now more frequently than ever. Nothing but fires from this time forward. Some would break out in broad day, others in the nighttime. As often as the sow farrowed, so

Ho-ti, finding the taste of the burnt pig to his liking, joined Bo-bo in finishing the remaining pigs.



Swayed by the pleasing taste of the burnt pig, the jury unanimously voted a verdict of "Not Guilty."

sure was the house of Ho-ti to be in a blaze, and Ho-ti himself, which was the more remarkable, instead of chastising his son, seemed to grow more indulgent to him than ever.

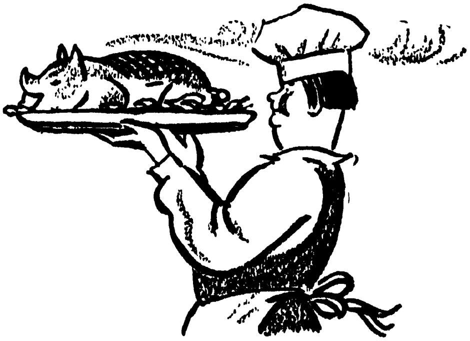
At length they were watched, the terrible mystery discovered, and father and son summoned to take their trial at Pekin, then an inconsiderable assize town. Evidence was given, the obnoxious food itself produced in court, and verdict about to be pronounced, when the foreman of the jury begged that some of the burnt pig, of which the culprits stood accused, might be handed into the box. He handled it and they all handled it, and burning their fingers, as Bo-bo and his father had done before them, and nature prompting to each of them the same remedy, against the face of all the facts and the clearest charge which judge had ever given—to the surprise of the whole court, townsfolk, strangers, reporters, and all present—without leaving the box, or any manner of consultation whatever, they brought in a simultaneous verdict of Not Guilty.

The judge, who was a shrewd fellow, winked at the manifest iniquity of the decision, and when the court was dismissed, went privily and bought up all the pigs that could be had for love or money. In a few days his lordship's town house was observed to be on fire. The thing took wing and now there was nothing to be seen but fires in every direction.

Fuel and pigs grew enormously dear all over the district. The insurance offices one and all shut up shop. People built slighter and slighter every day, until it was feared that the very science of architecture would in no long time be lost to the world. Thus this custom of firing houses continued, till in process of time, says my manuscript, a sage arose, like our Locke, who made a discovery that the flesh of swine, or indeed of any other animal, might be cooked (*burnt,* as they called it) without the necessity of consuming a whole house to dress it.

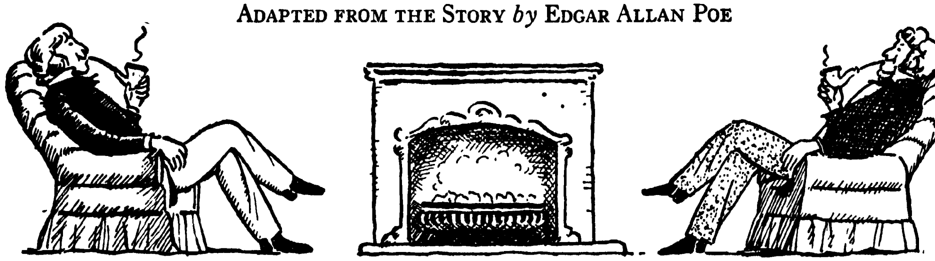
Then first began the rude form of a gridiron. Roasting by the string or spit came in a century or two later, I forget in whose dynasty. By such slow degrees, concludes the manuscript, do the most useful, and seemingly the most obvious, arts make their way among mankind.

Without placing too implicit faith in the account above given, it must be agreed that if a worthy pretext for so dangerous an experiment as setting houses on fire (especially in these days) could be assigned in favor of any culinary object, that pretext and excuse might be found in ROAST PIG.



THE PURLOINED LETTER

Adapted from the Story *by* Edgar Allan Poe



At Paris, just after dark one gusty evening in the autumn of 18—, I was enjoying the two-fold luxury of meditation and a meerschaum, in company with my friend, C. Auguste Dupin, in his little back library, when the door of our apartment was thrown open and admitted our old acquaintance, Monsieur G——, the Prefect of the Parisian police.

We gave him a hearty welcome, for we had not seen him for several years.

"And what is the difficulty now?" I asked. "Nothing more in the assassination way, I hope?"

"Oh, no; nothing of that nature. The fact is, the business is *very* simple indeed, and I make no doubt that we can manage it sufficiently well ourselves; but then I thought Dupin would like to hear the details of it, because it is so excessively *odd.*"

"Simple and odd," said Dupin.

"Why, yes; and not exactly that either. The fact is, we have all been a good deal puzzled because the affair *is* so simple, and yet baffles us altogether."

"Perhaps it is the very simplicity of the thing which puts you at fault," said my friend.

"What nonsense you do talk!" replied the Prefect, laughing heartily.

"And what, after all, is the matter on hand?" I asked.

"Why, I will tell you," replied the Prefect, as he gave a long, steady, and contemplative puff, and settled himself in his chair. "I will tell you in a few words; but, before I begin, let me caution you that this is an affair demanding the greatest secrecy, and that I should most probably lose the position I now hold, were it known that I confided it to any one."

"Proceed," said I.

"Or not," said Dupin.

"Well, then; I have received personal information, from a very high quarter, that a certain document of the last importance has been purloined from the royal apartments. The individual who purloined it is known. The thief is the Minister D——, who dares all things, those unbecoming as well as those becoming a man. The method of the theft was not less ingenious than bold. The document in question—a letter, to be frank—had been received by the personage robbed while alone in the royal *boudoir.* During its perusal she was suddenly interrupted by the entrance of the other exalted personage from whom especially it was her wish to conceal it. After a hurried and vain endeavor to thrust it in a drawer, she was forced to place it, open as it was, upon a table. The address, however, was uppermost, and, the contents thus unexposed, the letter escaped notice. At this juncture enters the Minister D——. His lynx eye immediately perceives the paper, recognizes the handwriting of the address, observes the confusion of the personage addressed, and fathoms her secret. After some business transactions, hurried through in his ordinary manner, he produces a letter somewhat similar to the one in question, opens it, pretends to read it, and then places it in close juxtaposition to the other. Again he converses, for some fifteen minutes, upon the public affairs. At length, in taking leave, he takes also from the table the letter to which he had no claim. Its rightful owner saw, but, of course, dared not call attention to the act, in the presence of the third personage. The Minister decamped, leaving his own letter — one of no importance — upon the table."

"Here, then," said Dupin to me, "you have precisely what you demand to make the ascendancy complete—the robber's knowledge of the loser's knowledge of the robber."

"Yes," replied the Prefect; "and the power thus attained has, for some months past, been wielded, for political purposes, to a very dangerous extent. The personage robbed is more thoroughly convinced every day of the necessity of reclaiming her letter. But this, of course, cannot be done openly. In fine, driven to despair, she has committed the matter to me."

"Than whom," said Dupin, amid a perfect whirlwind of smoke, "no more sagacious agent could, I suppose, be desired."

"You flatter me," replied the Prefect; "but it is possible that some such opinion may have been entertained."

"It is clear," said I, "as you observe, that the letter is still in the possession of the Minister, since it is this possession which bestows the power."

"True," said G——; "and upon this conviction I proceeded. My first care was to make thorough search of the Minister's hotel. The habits of the Minister gave me great advantage. He is frequently absent from home all night. His servants are by no means numerous and they sleep at a distance from their master's apartment. I have keys, as you know, with which I can open any chamber or cabinet in Paris. For three months a night has not passed, during the greater part of which I have not been engaged, personally, in ransacking the D—— hotel. My honor is interested, and, to mention a great secret, the reward is enormous. So I did not abandon the search until I had become fully satisfied that the thief is a more astute man than myself. I fancy that I have investigated every nook and corner of the premises in which it is possible that the paper can be concealed."

"But is it not possible," I suggested, "that although the letter may be in possession of the Minister, as it unquestionably is, he may have concealed it elsewhere than upon his own premises?"

"This is barely possible," said Dupin. "The present peculiar condition of affairs at court, and especially of those intrigues in which D—— is known to be involved, would render the instant availability of the document—its susceptibility of being produced at a moment's notice — a point of nearly equal importance with its possession."

"True," I observed; "the paper is clearly then upon the premises. As for its being upon the person of the Minister, we may consider that as out of the question."

"Entirely," said the Prefect. "He has been twice waylaid, as if by footpads, and his person rigidly searched under my own inspection." The letter was not found.

"You might have spared yourself this trouble," said Dupin. "D——, I presume, is not altogether a fool, and, if not, must have anticipated these waylayings, as a matter of course."

"Suppose you detail," said I, "the particulars of your search."

"Why, the fact is, we took our time, and we searched *everywhere.* I have had long experience in these affairs. I took the entire building, room by room, devoting the nights of a whole week to each. We examined, first, the furniture of each apartment. We opened every possible drawer; and I presume you know that, to a properly trained police-agent, such a thing as a '*secret*' drawer is impossible. Any man is a dolt who permits a 'secret' drawer to escape him in a search of this kind. The thing is so plain. There is a certain amount of bulk—of space—to be accounted for in every cabinet. Then we have accurate rules. The fiftieth part of a line could not escape us. After the cabinets we took the chairs. The cushions we probed with the fine long needles you have seen me employ. From the tables we removed the tops."

"Why so?"

"Sometimes the top of a table, or other similarly arranged piece of furniture, is removed by the person wishing to conceal an article; then the leg is excavated, the article deposited within the cavity, and the top replaced. The bottoms and tops of bedposts are employed in the same way."

"But could not the cavity be detected by sounding?" I asked.

"By no means, if, when the article is deposited, a sufficient wadding of cotton be placed around it. Besides, in our case, we were obliged to proceed without noise."

"But you could not have removed—you could not have taken to pieces *all* articles of furniture in which it would have been possible to make a deposit. A letter may be compressed into a thin spiral roll, not differing much in shape or bulk from a large knitting-needle, and in this form it might be inserted into the rung of a chair, for example. You did not take to pieces all the chairs?"

"Certainly not; but we did better—we examined the rungs of every chair in the hotel, and, indeed, the jointings of every description of furniture, by the aid of a most powerful microscope. Had there been any traces of recent disturbance we should not have failed to detect it instantly. A single grain of gimlet-dust, for example, would have been as obvious as an apple. Any disorder in the gluing—any unusual gaping in the joints—would have sufficed to insure detection."

"I presume you looked to the mirrors, between the boards and the plates, and you probed the beds and the bedclothes, as well as the curtains and carpets."

"That, of course; and when we had absolutely completed every particle of the furniture in this way, then we examined the house itself. We divided its entire surface into compartments, which we numbered, so that none might be missed; then we scrutinized each individual square inch throughout the premises, including the two adjoining houses, with the microscope, as before."

"The two houses adjoining!" I exclaimed; "you must have had a great deal of trouble."

"We had; but the reward offered is prodigious."

"You include the grounds about the houses?"

"All the grounds are paved with brick. They gave us comparatively little trouble. We examined the moss between the bricks, and found it undisturbed."

"You looked among D——'s papers, of course, and into the books of the library?"

"Certainly; we opened every package and parcel; we not only opened every book, but we turned over every leaf in each volume. We also measured the thickness of every book-cover, with the most accurate admeasurment, and applied to each the most jealous scrutiny of the microscope. Had any of the bindings been recently meddled with, it would have been utterly impossible that the fact should have escaped observation. Some five or six volumes, just from the hands of the binder, we carefully probed, longitudinally, with the needles. And now, Dupin, what would you advise me to do?"

"To make a thorough re-search of the premises."

"That is absolutely needless," replied G——. "I am not more sure that I breathe than I am that the letter is not at the hotel."

"I have no better advice to give you," said Dupin. "You have, of course, an accurate description of the letter?"

"Oh, yes!" And here the Prefect, producing a memorandum-book, proceeded to read aloud a minute account of the internal, and especially of the external appearance of the missing document. Soon after finishing the perusal of this description, he took his departure, more depressed in spirits than I had ever known the good gentleman before.

In about a month afterward he paid us another visit, and found us occupied very nearly as before. He took a pipe and a chair and entered into some ordinary conversation. At length I said:

"Well, but G——, what of the purloined letter? I presume you have at last made up your mind that there is no such thing as overreaching the Minister?"

"Confound him, say I—yes; I made the re-examination, however, as Dupin suggested —but it was all labor lost."

"How much was the reward offered, did you say?" asked Dupin.

"Why, a very great deal—a *very* liberal reward—I don't like to say how much, precisely; but one thing I will say, that I wouldn't mind giving my individual check for fifty thousand francs to anyone who could obtain me that letter."

"In that case," replied Dupin, opening a drawer, and producing a checkbook, "you may as well fill me up a check for the amount mentioned. When you have signed it, I will hand you the letter."

I was astounded. The Prefect appeared absolutely thunder-stricken. For some minutes he remained speechless and motionless, looking incredulously at my friend with open mouth, and eyes that seemed starting from their sockets; then, apparently recovering himself in some measure, he seized a pen, and after several pauses and vacant stares, finally filled up and signed a check for fifty thousand francs, and handed it across the table to Dupin. The latter examined it carefully and deposited it in his pocket-book; then, unlocking an *escritoire,* took thence a letter and gave it to the Prefect. This functionary grasped it in a perfect agony of joy, opened it with a trembling hand, cast a rapid glance at its contents, and then scrambling and struggling to the door, rushed at length unceremoniously from the room and from the house, without having uttered a syllable since Dupin had requested him to fill up the check.

When he had gone, my friend entered into some explanations.

"The Parisian police," he said, "are exceedingly able in their way. They are persevering, ingenious, cunning, and thoroughly versed in the knowledge which their duties seem chiefly to demand. Thus, when G—— detailed to us his mode of searching the premises at the Hotel D——, I felt entire confidence in his having made a satisfactory investigation—so far as his labors extended."

"So far as his labors extended?" said I.

"Yes," said Dupin. "The measures adopted were not only the best of their kind, but carried out to absolute perfection. Had the letter been deposited within the range of their search, these fellows would, beyond a question, have found it."

I merely laughed — but he seemed quite serious in all that he said.

"The measures, then," he continued, "were good in their kind, and well executed; their defect lay in their being inapplicable to the case and to the man. They consider only their own ideas of ingenuity, and, in searching for anything hidden, advert only to the modes in which *they* would have hidden it. They are right in this much—that their own ingenuity is a faithful representative of that of the mass; but when the cunning of the individual felon is diverse in character from their own, the felon foils them, of course. This always happens when it is above their own, and very usually when it is below. For example, in this case, do you not see the Prefect has taken it for granted that *all* men proceed to conceal a letter, not exactly in a gimlet-hole bored in a chair-leg, but at least, in *some* out-of-the-way hole or corner?

"D——, however, could not fail to be aware of the ordinary policial modes of action. He could not have failed to anticipate—and events have proved that he did not fail to anticipate—the waylayings to which he was subjected. He must have foreseen, I reflected, the secret investigations of his premises. His frequent absences from home at night, which were hailed by the Prefect as certain aids to his success, I regarded only as ruses to afford opportunity for thorough search to the police, and thus the sooner to impress them with the conviction to which G——, in fact, did finally arrive—the conviction that the letter was not upon the premises. I felt, also, that the whole train of thought, which I was at some pains in detailing to you just now, concerning the invariable principle of policial action in searches for articles concealed—I felt that this whole train of thought would necessarily pass through the mind of the Minister. It would imperatively lead him to despise all the ordinary nooks of concealment. He could not, I reflected, be so weak as not to see that the most intricate and remote recess of his hotel would be as open as his commonest closets to the eyes, to the probes, to the gimlets, and to the microscopes of the Prefect. I saw, in fine, that he would be driven, as a matter of course, to *simplicity,* if not deliberately induced to it as a matter of choice. You will remember, perhaps, how desperately the Prefect laughed when I suggested, upon our first interview, that it was just possible this mystery troubled him so much on account of its being so very self-evident?"

"Yes," said I, "I remember his merriment well."

"The more I reflected," continued Dupin, "upon the daring, dashing, and discriminating ingenuity of D——; upon the fact that the document must always have been *at hand,* if he intended to use it to good purpose; and upon the decisive evidence, obtained by the Prefect, that it was not hidden within the limits of that dignitary's ordinary search—the more satisfied I became that, to conceal this letter, the Minister had resorted to the comprehensive and sagacious expedient of not attempting to conceal it at all.

"Full of these ideas, I prepared myself with a pair of green spectacles, and called one fine morning, quite by accident, at the Ministerial hotel. I found D—— at home, yawning, lounging, and dawdling, as usual, and pretending to be in the last extremity of *ennui.* He is, perhaps, the most really energetic human being now alive—but that is only when nobody sees him.

"To be even with him, I complained of my weak eyes, and lamented the necessity of the spectacles, under cover of which I cautiously and thoroughly surveyed the whole apartment, while seemingly intent only upon the conversation of my host.

"I paid especial attention to a large writing-table near which he sat, and upon which lay confusedly some miscellaneous letters and other papers, with one or two musical instruments and a few books. Here, however, after a long and very deliberate scrutiny, I saw nothing to excite particular suspicion.

"At length my eyes, in going the circuit of the room, fell upon a trumpery filigree card-rack of pasteboard, that hung dangling by a dirty blue ribbon, from a little brass knob just beneath the middle of the mantelpiece. In this rack, which had three or four compartments, were five or six visiting cards and a solitary letter. This last was much soiled and crumpled. It was torn nearly in two across the middle—as if a design, in the first instance, to tear it entirely up as worthless, had been altered or stayed in the second. It had a large black seal, bearing the D—— cipher *very* conspicuously, and was addressed, in a diminutive female hand, to D——, the Minister, himself. It was thrust carelessly and even, as it seemed, contemptuously, into one of the uppermost divisions of the rack.

"No sooner had I glanced at this letter than I concluded it to be that of which I was in search. To be sure, it was, to all appearance, radically different from the one of which the Prefect had read us so minute a description. Here the seal was large and black, with the D—— cipher; there it was small and red, with the ducal arms of the S—— family. Here the address, to the Minister, was diminutive and feminine; there the superscription, to a certain royal personage, was markedly bold and decided; the size alone formed a point of correspondence. But, then, the *radicalness* of these differences, which was excessive; the dirt; the soiled and torn condition of the paper, so inconsistent with the true methodical habits of D——, and so suggestive of a design to delude the beholder into an idea of the worthlessness of the document;—these things, together with the hyper-obtrusive situation of this document, full in the view of every visitor, and thus exactly in accordance with the conclusions to which I had previously arrived; these things, I say, were strongly corroborative of suspicion.

"I protracted my visit as long as possible, and, while I maintained a most animated discussion with the Minister, upon a topic which I knew well had never failed to interest and excite him, I kept my attention really riveted upon the letter. In this examination, I committed to memory its external appearance and arrangement in the rack, and also fell, at length, upon a discovery which set at rest whatever trivial doubt I might have entertained. In scrutinizing the edges of the paper, I observed them to be more chafed than seemed necessary. They presented the broken appearance which is manifested when a stiff paper, having been once folded and pressed with a folder, is refolded in a reversed direction, in the same creases or edges which had formed the original fold. This discovery was sufficient. It was clear to me that the letter had been turned as a glove, inside out, redirected and resealed. I bade the Minister good-morning, and took my departure at once, leaving a gold snuff-box upon the table.

"The next morning I called for the snuff-box, when we resumed, quite eagerly, the conversation of the preceding day. While thus engaged, however, a loud report, as if of a pistol, was heard immediately beneath the windows of the hotel, and was succeeded by a series of fearful screams, and the shoutings of a terrified mob. D—— rushed to a casement, threw it open, and looked out. In the meantime I stepped to the card-rack, took the letter, put it in my pocket, and replaced it by a *facsimile* (so far as regards externals), which I had carefully prepared at my lodgings—imitating the D—— cipher, very readily, by means of a seal formed of bread.

"The disturbance in the street had been occasioned by the frantic behavior of a man with a musket. He had fired it among a crowd of women and children. It proved, however, to have been without ball, and the fellow was suffered to go his way as a lunatic or a drunkard. When he had gone, D—— came from the window, whither I had followed him immediately upon securing the object in view. Soon afterward I bade him farewell. The pretended lunatic was a man in my own pay."

"But what purpose had you," I asked, "in replacing the letter by a *facsimile?* Would it not have been better, at the first visit, to have seized it openly, and departed?"

"D——," replied Dupin, "is a desperate man, and a man of nerve. His hotel, too, is not without attendants devoted to his interests. Had I made the wild attempt you suggest, I might never have left the Ministerial presence alive. The good people of Paris might have heard of me no more. But I had an object apart from these considerations. You know my political prepossessions. In this matter, I act as a partisan of the lady concerned. For eighteen months the Minister has had her in his power. She has now him in hers—since, being unaware that the letter is not in his possession, he will proceed with his exactions as if it was. Thus will he inevitably commit himself, at once, to his political destruction. I confess, however, that I should like very well to know the precise character of his thoughts, when, being defied by her whom the Prefect terms 'a certain personage,' he is reduced to opening the letter which I left for him in the rack."

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In 1812 Captain Isaac Hull of the Constitution captured the first British frigate to strike her colors.

NAVAL HEROES *of* YOUNG AMERICA

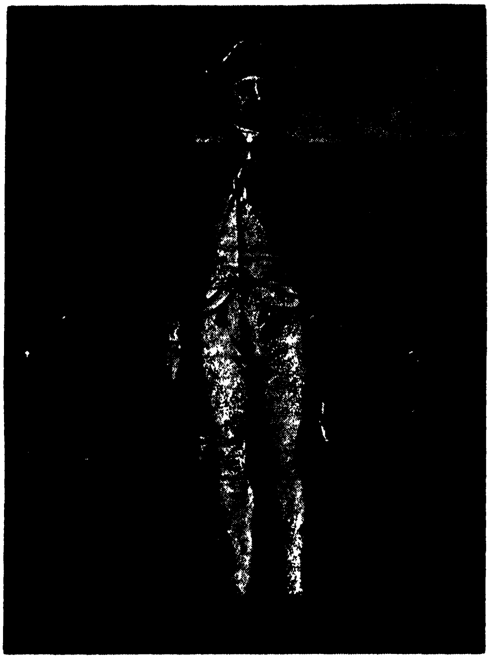
WHEN war broke out between the colonies and the mother-country, England was mistress of the seas. Her ships went everywhere and her colonies could send their merchantmen into any port open to them under England's protection. But when they were at war with her, all this was changed. The colonies had to fight their own battles and look after their own ships at sea. The colonists owned many trading ships, but they had never had any reason to build ships of war for protection.

They had little difficulty in gathering together a crude army. Soldiers were in the field at a moment's notice. But to get a navy able to fight the English men-of-war was not such an easy matter. It took a long time to build warships, and the expense of fitting out vessels for action was great—greater than the colonists could then afford. So when troubles between the colonies and the mother-country began, the colonists had not a single ship large and strong enough to meet any one of the British fleet.

There was a crying need for naval protection of some kind. Coast towns were open to attack by the enemy, ships carrying American troops and supplies had to run great risks. It was a trying situation for the struggling colonists, but they planned to make the best of it. So they allowed hundreds of small boats to be fitted out by private persons. These boats, called privateers, by attacking English merchantmen made it necessary for the British fleet to guard her own; and the more warships were used in this way, the less they could be used to attack American commerce. The privateers also helped the colonists to carry on commerce after a fashion, though with some risk.

But, after all, this was but a makeshift of a navy. Something better was soon needed, and the colonists could no longer close their eyes to the fact. The first session of the Continental Congress had said nothing about ships, but by the time the second session met, the situation was felt as serious. A marine or naval commission was appointed "to consider, inquire and report with respect to the organization of a naval force."

Fortunately for the colonists, there was one man among them, a Virginia planter, whose early life as an English seaman made



John Paul Jones, who helped to organize the American Navy in the dark days of the Revolution.

him able to advise them about the kind of ships that would give the best service in the war. The name of this man, a native of Scotland, was John Paul, but after he came to America he added Jones to his name. The commission invited him to come to the meeting, and he went.

They met at Philadelphia. John Paul Jones gave them excellent advice as to the choice of ships and men for the navy. He showed them that they could not hope to fight for the mastery of the seas with England. Only three nations had had fleets strong enough to do that, and these fleets had been the growth of centuries. Those three nations were, of course, Spain, France and Holland.

The colonists needed frigates rating from thirty-two to thirty-six guns. Jones thought a squadron of four, five or six of such ships should be constantly kept in British waters and do the kind of sea fighting that harasses the enemy most. Last of all, one sharp encounter, with the prize taken into some French port, would attract the attention of all Europe and raise the colonists in European eyes more than any battle on land would do. Congress took the suggestion, and on December 13, 1775, ordered thirteen frigates built.

While at Philadelphia the commission asked John Paul Jones' judgment about some ships which Congress had an opportunity to buy. There were about twenty of all sorts and sizes, and they lay moored a short distance from the wharf. He found four fit for service—two ships, the Alfred and the Columbus, and two brigs, the Andrea Doria and the Cabot. Congress bought them, and these four merchantmen, made useful as warships, formed the foundation of our American navy. Esek Hopkins, now almost forgotten, was made commander-in-chief.

With these and other weak ships Hopkins did something to oppose the strong British navy. One of his lieutenants, a former captain of a merchant ship, John Barry, in the Lexington, captured the Edward, the first ship taken. He later had command of the Raleigh. John Paul Jones, after some small successes, sailed to carry the war into British waters.

DARING JOHN PAUL JONES CAPTURES THE BRITISH WARSLOOP DRAKE

He attacked the forts at Whitehaven first, then landed on the Scottish shore, alarming the people wherever he went. The British were exasperated at the daring of this man, whom they insisted upon calling a pirate. There is no telling what harm he would have done to the enemy if his plan to go right around the British Isles had not been changed. While crossing the Irish Channel, however, he met a British sloop of war, the Drake. After some sharp fighting he captured her and brought her with great pride into a French port. She was a vessel of greater force than the American ship, and when the prize was brought in the Frenchmen could scarcely believe their eyes.

This was not enough. He still had in mind an expedition that would give him the longed-for chance for one good sharp encounter with the enemy. That would make a lasting impression. The Drake was only a small ship, as was the Ranger. His victory had amazed France, but he meant the next time to startle the world. With this object in view he did all in his power to gather together a squadron of ships. France could give him little help, as she was at war with England herself and needed all her vessels. Benjamin Franklin, who represented the United States in France at that time, did what he could to help. But there was little money at his disposal, and Congress could not spend any more then for ships. As a last resort Jones appealed to the King. Louis XVI, in spite of his own pressing need of ships, gave him a large vessel. She was the Duras, an old merchantman. He immediately changed her name to the Bon Homme Richard, in honor of his friend Benjamin Franklin, who was the author of POOR RICHARD'S ALMANAC. Within three months Jones had a squadron of five ships ready and was off to sea.

They spent the summer cruising about the British coast, and this contemptible little squadron, as one Englishman called it, did much more to alarm and annoy the people than the whole French navy had been able to do. One morning a British convoy of forty sail was sighted off Flamborough Head. They were merchantmen bound for Scarborough Head under the protection of two men-of-war, the Serapis, under Captain Pearson, and the Countess of Scarborough, under Captain Piercy. Ordering all his ships to fall in line, Captain Jones immediately gave chase. The British merchantmen crowded sail and got away, but the men-of-war accepted the challenge and came up to fight.

Esek Hopkins, chief of our first Navy.

Naval history does not record a more determined and terrible struggle. At one time firing on the Bon Homme Richard ceased and Captain Pearson asked if the Bon Homme Richard had surrendered. "No, I have not yet begun to fight," answered Captain Jones.

It was soon clear to the American captain that his only chance of success was to board the enemy's boat, if possible, and to fight it out man to man. Skillful maneuvering brought the two boats side by side, and as the Bon Homme Richard grazed the Serapis the fluke of one of her anchors caught fast in the mizzen chain of the Bon Homme Richard. Captain Jones lashed the boats together quickly and in this way made the grapple he had tried so hard to effect and Captain Pearson had tried so hard to avoid. Captain Pearson struck his own colors. The next day the Bon Homme Richard sank in spite of every effort, yet she captured the ship that sank her.

At the end of the war with England the Americans had but one warship left, the Alliance, and she was sold for a merchantman the next year. It was clear that the new nation meant to get on without a real navy. Only a few tiny boats were kept. In spite of the heroic work done upon the seas the people thought a real navy unnecessary. They soon learned otherwise.

Trouble with France came first. France was still at war with England and looked to the Americans to protect the French West Indies. President Washington was determined to avoid joining in the quarrel, and France then attacked our ships.

Three frigates, the Constellation, the Constitution and the United States, had been built in 1794. The senior officer with the rank of commodore was the same John Barry who had done good work during the Revolution. Congress soon had this infant navy in West Indian waters. Two sharp encounters taught the French that the little squadron had to be reckoned with. The Constellation, under Captain Thomas Truxton, met the French frigate L'Insurgent off St. Kitts, and after hard fighting, forced the French ship to haul down her flag. One year later the Constellation silenced the frigate La Vengeance in a few hours, and made her strike her colors. Both English and French seamen were amazed. The French soon came to terms.

The clash with France was scarcely ended before the Americans' love of peace was again sorely tried. For a long time pirates from the Barbary States had been preying upon the commerce of all the Christian nations. The countries of Europe had paid tribute to these sea robbers as a means of protection, and the United States did the same. But the more the United States paid them, the more dissatisfied these priates became. There was nothing left to do but to fight it out. War was declared and the Americans soon had a squadron in the Mediterranean under Edward Preble. Stephen Decatur, William Bainbridge and Charles Stewart did some brilliant work.

When the Philadelphia, under Captain Bainbridge, ran upon a reef in the harbor of Tripoli she fell into the hands of the enemy and made a fine addition to their naval force. Stephen Decatur offered to go into the harbor and destroy her. Now, the Philadelphia lay close to the shore with a pirate crew and surrounded by hundreds of the enemy's guns. In the face of all these odds the young Decatur, with seventy men, reached the ship, boarded her and overpowered the crew. In a few minutes the Philadelphia was ablaze and Decatur with his men were on their way back midst a storm of shot and shell.

THE STRUGGLE BETWEEN NATIONS FOR FREEDOM OF THE SEAS BRINGS ON WAR

All this time the United States restlessly held her peace with England, but trouble was not long to be avoided. England in her life-and-death struggle with France had kept many of the French ships in port, and most of the carrying trade of the world was done in American merchantmen. If they risked a voyage to a French port, they were likely to be seized by an English man-of-war, and if they were bound for an English port, they were likely to be seized by the French.

The Americans were exasperated at the situation, but the feeling grew worse when England stopped American merchant vessels, when and where she chose, and carried off seamen she claimed were British subjects. American wages were so high that thousands of British seamen had deserted and signed on American ships. Most countries then did not agree that a man could change his citizenship, and Great Britain not only took off many recent deserters but also many who had naturalization papers, and some who were American-born. This caused great irritation. War was declared in 1812.

Brilliant as the naval victories of the Americans had been whenever they were brought to fight, the country placed its chief reliance in this war on the militia. The idea that our naval ships were able to meet those of the English seemed ridiculous, and not without reason, for we had only a few ships as against England's fleet of many hundred. The English had a poor opinion of our "fir-built things with a bit of striped bunting for a flag at the masthead."

The first encounter on the seas took place when the American frigate Constitution, under Captain Isaac Hull, met the English frigate Guerrière a hundred miles east of Boston. The meeting was welcome on both sides, for Captain Dacres of the Guerrière challenged any American frigate to meet him in a ship duel. The Guerrière opened fire, but Captain Hull held back. He meant that every shot should tell. Crouching until the Guerrière was within pistol range, he sprang up and shouted, "Now, boys, pour it into them." The Constitution fired a whole broadside. The masts of the Guerrière fell; great holes were torn in her sides, and in less than thirty minutes from the time the firing began, she struck her flag to the Constitution. Not a spar was left standing, and her hull was so damaged that it was hard to keep her above water. Captain Hull could not even bring his prize into port, so he blew her up and returned to Boston with his prisoners.

No less brilliant was the victory of the United States, under Captain Stephen Decatur, over the Macedonian. Decatur, in the United States, was sailing eastward in the neighborhood of the Azores, when he sighted a sail. The stranger made chase, and proved to be the English frigate Macedonian, under Captain Carden. The enemy soon came abreast the United States, and action began. The fighting lasted one hour and a half, when the Macedonian struck her colors, almost a total wreck.

The same year the Constitution, under Captain William Bainbridge, made another splendid capture. She fell in with the Java, a ship of the same tonnage as the Guerrière, just off the Brazilian coast. The Constitution waited until within pistol range of the enemy, when the command to fire was given. In less than two hours the Java was fairly shot to pieces.

THE CONSTITUTION, "OLD IRONSIDES," IS STILL AFLOAT

Captain Bainbridge was obliged to blow her up and land at San Salvador without his prize. The Constitution was ready for another fight two hours after the battle, and the Americans were so carried away with enthusiasm for this ship that they proudly called her Old Ironsides. Years afterward, when it was proposed to break up this ship, which was no longer of service, Oliver Wendell Holmes wrote that spirited poem, OLD IRONSIDES, which you will find in the department of Poetry. People were so stirred by this poem that the Navy changed its plan, and the Constitution remains afloat to this day, a memorial to the past.

The capture of the British sloop of war Peacock by the American boat Hornet, under Master Commander James Lawrence, was much like the preceding victories in its results. The fire of the American was rapid and accurate. In eleven minutes from the

DECATUR AND THE PIRATES AT TRIPOLI

In 1815 war was declared by the United States upon the Barbary States, whose pirate bands had been preying on ships of all nations in the Mediterranean and demanding tribute in return for "protection." An American squadron under Edward Preble hurried to the harbor of Tripoli. There the Philadelphia was grounded and taken over as a prize by the enemy. Young Stephen Decatur volunteered to go into the harbor and destroy her. With seventy men he boarded the ship, overpowered the savage crew and set the ship ablaze. Then, surrounded by hundreds of enemy guns, the victorious Decatur and his men made their way safely back to their comrades.

time the firing began the Peacock was disabled and sank in spite of every effort to save her.

There had been a battle in the meantime between the sloops of war, the American Wasp and the British Frolic. The two vessels met off the North Carolina coast at a time when a heavy sea was running, which caused both to pitch and roll so that marksmanship was difficult. Often the muzzles of the guns were under water. The enemy surrendered after forty-three minutes of terrible fighting. But Commander Jones lost the full satisfaction of his victory, for while the crew in the Wasp was repairing damages a British frigate came into view, recaptured what was left of the Frolic and took her and the Wasp to Bermuda.

Never had the English suffered such a series of defeats as the Americans inflicted upon their navy. Even the smaller vessels were victorious. The Enterprise took the Boxer. The Essex, under Captain David Porter, sailed around Cape Horn and captured many merchantmen. One Englishman said that there was scarcely an American ship that could not boast a victory.

DURING A SHIP DUEL CAPT. LAWRENCE CRIES, "DON'T GIVE UP THE SHIP!"

The first ship was lost when the frigate Chesapeake surrendered to the Shannon. The Chesapeake was at anchor in Boston Harbor, where Captain James Lawrence was sent to fit her out for sea. When he arrived there he found that nearly all of her old crew had left the ship, and Captain Lawrence was forced to man the vessel with a crew of untrained, riotous men. While he was gathering them together Captain Broke of the Shannon sent a challenge to the Chesapeake asking for a ship duel in any place that the American captain named. He accepted the challenge and met the Shannon at sea. After a short, fierce fight the fire of the Shannon proved too much for the shattered Chesapeake. Captain Lawrence was mortally wounded and his dying words were, "Don't give up the ship," but this surrender could not be prevented.

This loss was followed by others. The American ships were so few that before long they were either captured or blockaded in port. But the American navy had made a record that will never die.

Meantime the war was being waged on land and on the Great Lakes. One decisive battle, won by Oliver Hazard Perry, gave the Americans the command of Lake Erie, and this battle has stirred Americans as few battles in our history have ever done.

The loss of Detroit soon after the war began was a great blow, for the British then came into possession of the whole Northwest Territory, and with it passed the control of Lake Erie. Now, Detroit without the command of the lake would have been of little use to the British, for at that time it was impossible to send sufficient supplies overland to the British soldiers stationed there. So if the Americans could get back the control of Lake Erie, the first step toward recapturing Detroit, and in the end all of the Northwest Territory, would have been taken.

OLIVER HAZARD PERRY BUILDS SHIPS FOR VICTORY ON THE GREAT LAKES

Things looked unfavorable for the Americans when Oliver Hazard Perry, a young naval officer, was sent to Presqu' Isle, on Lake Erie, to take charge of a small squadron that was being built there. Perry, who had been in the Navy from his fifteenth year, had served as a midshipman in the war with Tripoli. After the War of 1812 began he was for some time in command of a little fleet of gunboats on the Atlantic coast, and though he was only twenty-seven, he had already given proof that he was a skillful commander as well as a brave and daring man.

When he arrived at his new station he found the keels of two brigs laid and three gunboats well under way. One was the Lawrence, named after the unfortunate captain of the Chesapeake, and the other was called the Niagara. With a gang of ship carpenters young Perry set to work to finish building and to equip a little squadron in a place that was almost a wilderness. They cut down trees from the western shore of the lake and used the green timber for the vessels, while most of the material for equipping the ships had to be brought five hundred miles from the seaboard.

The British had been building ships, too, and their new ship, the Detroit, was nearly ready for service.

The quick work of the American seamen had aroused the alarm of the British. Captain Barclay, one of Nelson's veterans, in command of the British fleet, meant to have his squadron on the lake and keep the American ships blockaded near Presqu' Isle, but Perry was too quick for him. His ships were already on Lake Erie and he was on the lookout for the British.

The British squadron, finding Perry in

Perry on his flagship, the Lawrence, at the battle of Lake Erie, where he captured an entire British fleet.

full control of the lake, remained at Malden, on the Detroit River. Captain Barclay had great trouble to get a crew, and he was determined not to come into action until he had what he thought was the full equipment of seamen. But difficulties about the food supply were staring him in the face. He could no longer get food in his neighborhood, and the presence of the American squadron made it impossible for him to reach Long Point, the supply station, without coming into open fight.

In the meantime the American squadron had decided not to wait for the enemy, but to sail over to Malden and attack the British at that place. So Perry's fleet set sail for that purpose. At sunrise on September 10, 1813, the lookout at the masthead of the Lawrence sighted the British squadron in the northwest. Captain Barclay's seamen were hungry, and he had decided that he must open communications with Long Point even if it meant fight.

There was some difference in the strength of the two fleets. Perry had nine ships, while the British had six, but the latter carried more guns. The British vessels were larger, but their guns were smaller; and Captain Barclay had served under Nelson at Trafalgar, while the young American commander had to make up in spirit what he lacked in experience. But he had spirit enough for what was to follow. "To windward or leeward they shall fight today," was his command when the British hove in sight.

Perry, in his flagship the Lawrence, displaying a blue banner bearing the words "Don't Give Up the Ship," advanced, but the British in line in close order awaited the attack. The Lawrence hailed. The British waited until she was within range and then made her a target for their fire. The fighting that followed was most desperate, and the Lawrence was soon almost a wreck. Perry fought her until nearly all of his men had fallen. It was a supreme moment—most men would have surrendered. He saw it would be madness to stay longer in his shattered ship. With eight men and his little twelve-year-old brother he jumped into a rowboat and, standing, blue flag in hand, made straight through a shower of shot and shell for the Niagara, another vessel of his fleet, which had not suffered much harm.

With renewed energy the battle then raged with greater violence than before. The few men left on the Lawrence were compelled to haul down their flag, but the British were too busy to take possession of her. Perry sailed into the very midst of the British fleet. He tore through their lines, pouring broadsides right and left. In fifteen minutes Captain Barclay was compelled to surrender, and Perry's great victory on Lake Erie was won. For the first time in history a dispatch bore the message that an entire English fleet had been captured. "We have met the enemy and they are ours—two ships, two brigs, one schooner and one sloop."

As a reward for his victory Perry was made a captain, was thanked by Congress, and was presented with a gold medal. He did not live long to enjoy his honors. At that time it was necessary to keep warships in West Indian waters to protect American ships against pirates who infested them. Six years after his victory Perry was sent down with a squadron to perform this duty, and died there of yellow fever on his thirty-fourth birthday. A hundred years later great celebrations were held at different points along Lake Erie, and at Put-in-Bay a memorial was unveiled to the men who had fought so bravely and so well. Matthew C. Perry, who commanded the fleet which opened Japan to the world almost forty years later, was a younger brother of Oliver Hazard Perry.

In Lake Champlain was another American fleet of fourteen small vessels under Thomas Macdonough. This was attacked September 11, 1814, by a large British fleet under Captain Downie, but Macdonough's bravery and skill won the day. Peace was soon declared with all honor of the war due to the Navy. Except at New Orleans, no important victory had been won by the army.

The United States has now the largest and strongest navy in the world. One of the smallest armed ships of the present day could destroy the whole fleet of the War of 1812, but Americans will never forget the struggles and the glories, the sailors and the ships of those times.

During the century and more since the close of the War of 1812 the American navy has always been ready to fight, even in the days when it was small and weak. During the Civil War, the Spanish-American War and the two world wars, the Navy bore itself well, but we can not stop here to tell of Farragut, Porter, Dewey, Sampson, Schley, Halsey, Nimitz and all the rest. Whether they serve upon battleships, destroyers or submarines, the American officers and sailors have always been ready to do their whole duty.

THE NEXT STORY OF MEN AND WOMEN IS ON PAGE 6385.

At Lake Champlain the small fleet under Thomas Macdonough, shown at the gun, fought and won the final naval battle of the War of 1812. When peace came, America duly honored her gallant and victorious Navy.

Photo from Leet Brothers

The two little ships of Sir Walter Raleigh's expedition of 1584 sail away to explore the American coast.

The LOST COLONY *of* ROANOKE

IN other volumes of our book you will find much said about Sir Walter Raleigh. His most important claim to the admiration of American boys and girls has been hardly mentioned, however, and this story will tell you why Americans should respect his memory. He had the idea of building up a new England in America, and gave much of his money and spent much of his time to bring it about, only to fail in the end. The failure was not his fault but was a great grief to him. The story of the Lost Colony of Roanoke is one of the most romantic in American history.

The first expeditions to the New World were not sent with the idea of permanent settlement. They spent their time looking for the passage to India and China, or else sought only gold and silver. Walter Raleigh and his half-brother Sir Humphrey Gilbert were among the first Englishmen who desired to set up "little pieces of England" in America. They started with seven small ships in 1578, but whether to explore America or to capture Spanish treasure ships is not quite certain. At any rate, they had a fight with the Spaniards and returned without success. Sir Humphrey Gilbert was lost at sea returning from a voyage to Newfoundland in 1583. Raleigh was not discouraged. The next year Queen Elizabeth made him a knight and gave him permission to settle any "remote heathen and barbarous lands" still unoccupied by Europeans, giving the people who should settle there all the rights of Englishmen, including the right to make their own laws.

Raleigh soon sent out two little ships commanded by Philip Amadas and Arthur Barlowe. They touched Florida and sailed along the coast until they reached what is now North Carolina, on July 4, 1584. Following the coast, they came to a gap in the sand banks which fringe it and entered Pamlico Sound. They landed upon an island which to their eyes seemed a paradise. The stately pines, the cedars, and the abundance of grapes, which, they reported, grew down to the water's edge, filled them with wonder. Game and fish were also plentiful. The Indians called the island Roanoke, and it bears that name to this very day.

The Indians were friendly and brought the white men fish, and were much pleased with a few trifles given them. The explorers visited the Indian village and were charmed with all they saw. Two of the Indians agreed to go to England with them. The name of one was Manteo, and the little town on the island today bears his name. The whole country was named Virginia, in honor of Queen Elizabeth, sometimes called the Virgin Queen.

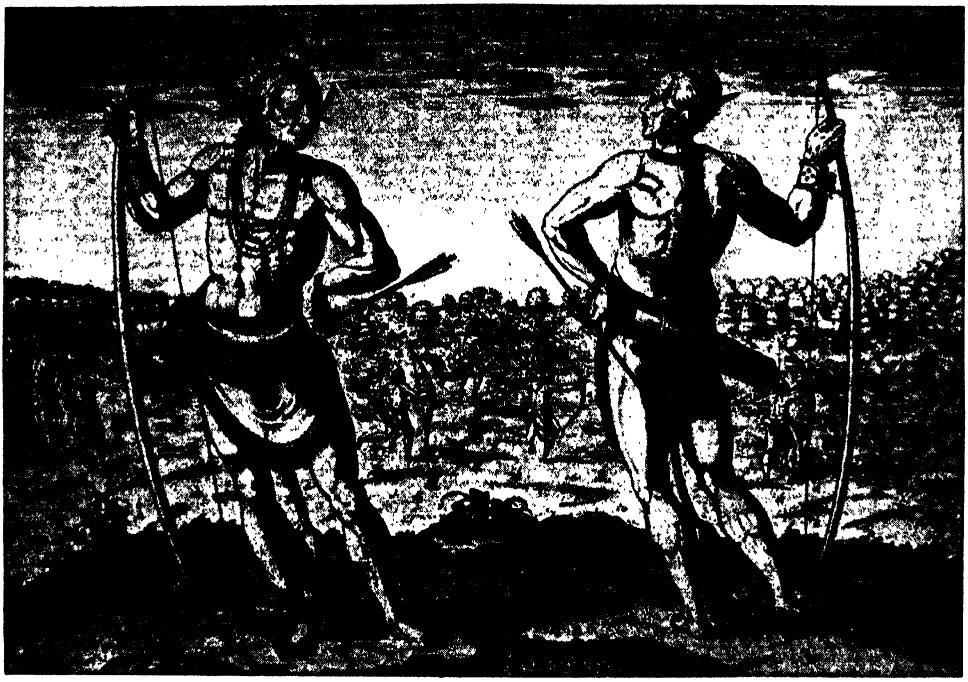
Sir Walter Raleigh was delighted with

the report of his explorers, and early in 1585 sent out over a hundred men under Ralph Lane to found a colony. Unfortunately Sir Richard Grenville, who commanded the ships which took them over, quarreled with the Indians and set fire to their corn.

The little colony built a little fort as a center for the "City of Raleigh," but seems to have spent more time in exploring and hunting gold than in planting crops. Some of the men followed the broad Roanoke River, hoping to find a passage to China.

As the Indians refused to sell their corn, the party began to suffer for want of food the next year, and the expected supplies did not come from England. Just at this time Sir Francis Drake, the famous English admiral, stopped on his way home from an expedition against the Spaniards. He agreed to take the hungry, homesick men back to England, as they asked.

A little while later Sir Richard Grenville arrived with the supplies which had been delayed, only to find the island uninhabited.



One of John White's pictures of the Indians of Roanoke Island. White drew them very carefully, with great attention to detail, so that we can see the designs the Indians painted on their bodies and note the way in which they fastened on the quivers that held their arrows. The Indians in the background are shooting deer as they run.

One of the party was John White, who had some skill in drawing. He made pictures in water colors of the Indians at work and at play and of their houses. Some of these were published at Frankfort, in Germany, in 1590, five years after they were made, to illustrate the story of the expedition written by Thomas Hariot, the famous mathematician. Both story and pictures tell us much of Indian customs before they were changed by the white men. John White let his fancy roam in some particulars, however, for he drew many Indians with long tails! We show you here some photographs of the drawings.

He could not believe that all the men were dead and did not guess that they had gone back to England. He thought that they were somewhere on the mainland hunting gold or trying to get to China, and so he left abundant supplies, with a guard of fifteen men, and sailed back to England.

England was then stirred up over the war with Spain, which all saw was coming, but Sir Walter Raleigh would not give up the idea of planting a colony. So in the next year, 1587, he sent out another colony, of about 150 men, women and children, under the same John White who drew the pictures we show you here. Governor White was or-

THE FEAST OF FIRE

John White's picture of Indians holding a solemn feast of fire to celebrate their deliverance from danger. A fire is built and the men and women gather around it singing and making a great noise. The rattles some of them are shaking are dried gourds filled with stones. You can imagine what a satisfying noise they make.

The Indians made boats from tree trunks, setting fire to the roots and then burning and scraping out the logs. The man on the right is controlling the fire so that it does not burn out too much of the wood.

dered to go to Roanoke Island, get the supplies and the fifteen men left there the year before, and then go farther north into Chesapeake Bay, where there were better harbors. The commander of the ships, however, was anxious to get back to Europe, and after a part of the men had gone to Roanoke Island in a small ship, he landed all the rest on the coast, and sailed away. So the third colony was forced to settle there.

The party looked in vain for the fifteen men and the supplies, but found only a skeleton here and there. The Indians had killed the men and taken some of the supplies and destroyed what they did not care for. Since the ship had sailed away, the colony had to remain, and all set to work to build new huts. In the party was the governor's daughter, Eleanor White, who was the wife of Ananias Dare, one of Governor White's assistants. To them was born, August 18, 1587, soon after they landed, a little daughter whom they named Virginia in honor of the country. This little girl, Virginia Dare, was the first child born of English parents in what is now the United States. The county in North Carolina of which Roanoke Island is a part is called Dare County in her honor.

Since the Indians had not only killed the men, but had taken or destroyed the stores and supplies they were set to guard, the colony had great need of many things in order to live. Governor White therefore thought it necessary to take the one little ship left them and start back to England for help. His little granddaughter was then only about a week old. Ananias Dare went with his father-in-law.

When White arrived in England the great Armada, with which Philip of Spain expected to conquer England, was almost ready, and every ship in England was being prepared to fight. Sir Walter Raleigh made two attempts to send aid to his little colony. Once the ships were seized for the government, and the second expedition, under Governor White, was driven back by Spanish ships. Then came the Armada, about which you may read elsewhere in your book. There followed many months of fighting, in which Raleigh had a prominent part.

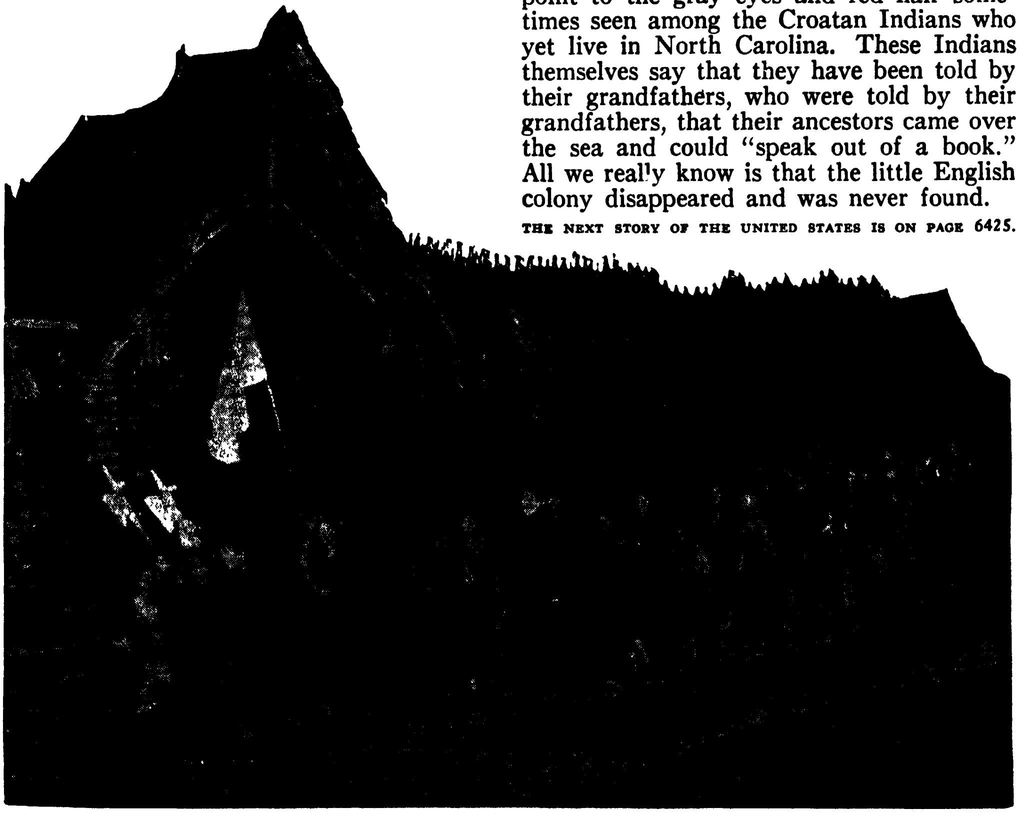
Finally poor Governor White, who must have been almost distracted, arranged with a sea captain sailing to the West Indies to take him and Ananias Dare as passengers and to stop at Roanoke Island on his return voyage. In August, 1590, when little Virginia Dare would have been three years old, her father and grandfather reached Roanoke Island.

On the island there was not a sign of human life. The doors of the huts stood open and grass grew in the fort. Chests and boxes which had been buried had been dug up. Some of Governor White's books and drawings had been scattered to the winds. There were no signs of a struggle, and the only clue was the word "Croatan" carved deep on a great tree. This was the Indian name of an island, now a peninsula, about fifty miles away. We are told that the ship proceeded toward that place, but one of those severe storms common on that coast sprang up, and after beating about for several days the captain, in spite of the prayers of the father and grandfather, set sail for England, leaving the colonists to their fate. Raleigh made two further efforts to find his colony, five in all, and after the failure of his last, in 1602, just before he was imprisoned, declared that he would yet see "an English nation in Virginia." He was sent to prison by James I in 1603 and was put to death in 1616. Before his death the colony of Jamestown had been founded by others, and that little colony survived.

The settlers at Jamestown, after their arrival in 1607, were told by the Indians that the colony of Roanoke had lived peacefully among the Indians for several years, adopting the Indian mode of life. Finally the medicine man had stirred up the tribe to murder all except four men, two boys and a girl. Perhaps this story is true, perhaps not. If so, was this girl Virginia Dare? Among the works of Mary Johnston, who wrote several romances of colonial days in the South, is a story called CROATAN. In it she pictured the weary waiting for a ship from England. Since the summer of 1937, a pageant telling the story of the colony has attracted thousands of visitors yearly.

To this day many believe that some of the colonists were adopted by the Indians and married with them. As proof they point to the gray eyes and red hair sometimes seen among the Croatan Indians who yet live in North Carolina. These Indians themselves say that they have been told by their grandfathers, who were told by their grandfathers, that their ancestors came over the sea and could "speak out of a book." All we really know is that the little English colony disappeared and was never found.

THE NEXT STORY OF THE UNITED STATES IS ON PAGE 6425.



North Carolina Department of Conservation and Development

The final scene of Paul Green's pageant of the Lost Colony shows the colonists marching off into the darkness and into mystery. This pageant is enacted every year on Roanoke Island, now a North Carolina state park.

SOME STATES OF CENTRAL EUROPE

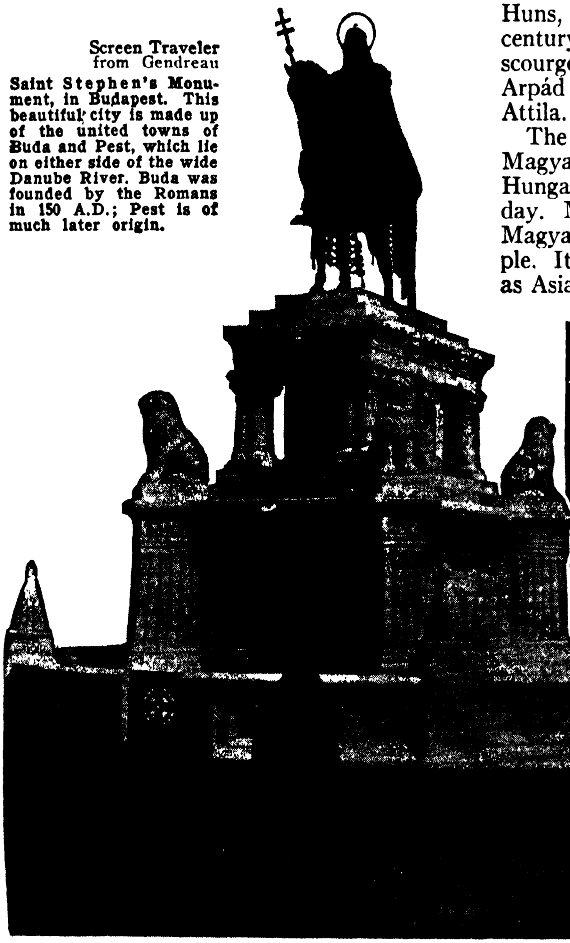
HUNGARY AND HER NEIGHBORS

IN the great Danube plain, as it sweeps down through eastern Europe, is the country of Hungary. On all sides it is walled in by mountains, as you can see on the map. To the north are the Carpathian Mountains and on the east are the Transylvanian Alps. To the west you will see the Austrian Alps. South of Hungary run the great mountain ranges of Yugoslavia.

Hungary is a flat country, watered by rivers which flow down to join the Danube. As you might expect, agriculture is the chief occupation of the country. There are broad fields of grain and other crops, and great plains where sheep and cattle graze. The cowboys of Hungary, who tend these herds, are picturesque figures, like the cowboys of the West in the United States and the gauchos on the great plains of South America.

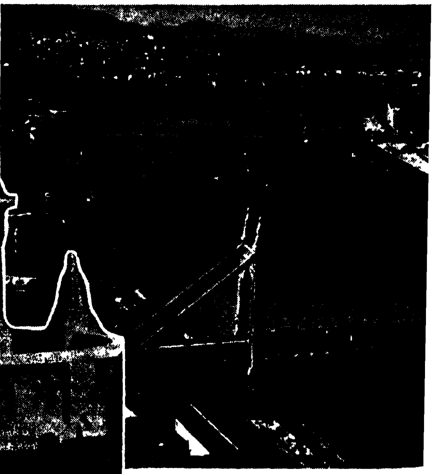
It is natural, perhaps, that Hungarians should be fine horsemen, for they are partly descended from a nomadic tribe which came from Asia and burst into Europe about the year 900 A.D. under a leader named Arpád. The name Hungarian reminds us of the Huns, those terrible invaders in the fifth century A.D., with their leader Attila, "the scourge of God." Probably the followers of Arpád were distantly related to the men of Attila. Both were originally Mongol peoples.

The followers of Arpád called themselves Magyars, and that is the name by which Hungarians wish to be called to this very day. Magyar is pronounced Modyor. The Magyars have remained the dominant people. It is not hard to think of the Magyars as Asiatic people if you hear their language



Screen Traveler from Gendreau

Saint Stephen's Monument, in Budapest. This beautiful city is made up of the united towns of Buda and Pest, which lie on either side of the wide Danube River. Buda was founded by the Romans in 150 A.D.; Pest is of much later origin.



Philip Gendreau, N. Y.

View of Budapest from Gellert Hill. The Danube River was spanned by a number of bridges before the war, but most of these were destroyed by bombs. On the right bank of the river you see the quays of Pest.

or see it written; it is very different from the European languages.

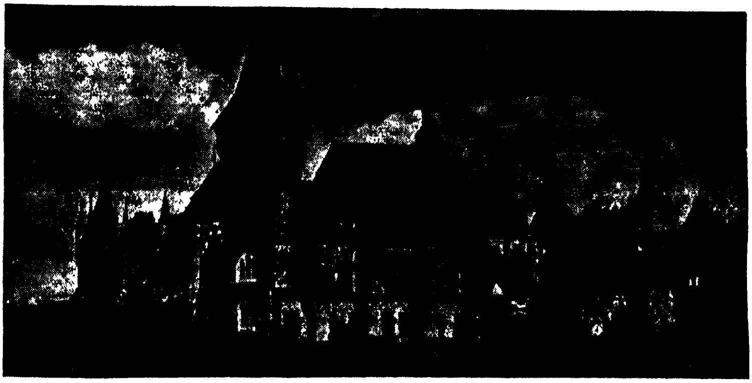
The great hero of early Hungarian history is St. Stephen (997-1038). He was a wise and noble king who formed the land into a great nation, and gave the people a constitution, parts of which remained in force down to modern times. Christianity had already come to Hungary and Stephen did much to further its spread. Hungary followed the Western, rather than the Eastern, Empire in religion, and its people today are mostly Roman Catholics, instead of Greek Orthodox Catholics as in many of the neighboring countries.

Situated in the very heart of Europe, Hungary has played the part of a buffer state for many centuries. In early times it stood between the Holy Roman Empire, which dominated most of Europe, and the Byzantine Empire, which ruled the Near East from its capital at Constantinople. In the Middle Ages, Mongol hordes swept in upon the land, and later came the Turks, who oppressed Hungary during a long period of her history. Some of the great leaders of those days were the Hungarian kings Sigismund and Matthias, and the brilliant soldier John Hunyadi. The battle of Mohacs in 1526 was a terrible Turkish victory, and after that Hungary was cut in pieces, part going to the Turks and part to Austria. Slowly and painfully the Hungarians won back their freedom. They shook free from the Turks in 1700, and obtained a guarantee of their full rights and privileges from Austria in the Peace of Szatmar in 1711.

It was fortunate for Austria that peace and friendship were established between the two countries, for soon afterward Austria was beset with difficulties. A woman came to the throne, the Empress Maria Theresa. She was threatened by several of the countries of Europe, and especially by the king of Prussia, Frederick the Great. Seeking aid, the Empress appealed personally to the Hungarian nobles and won their enthusiastic support.

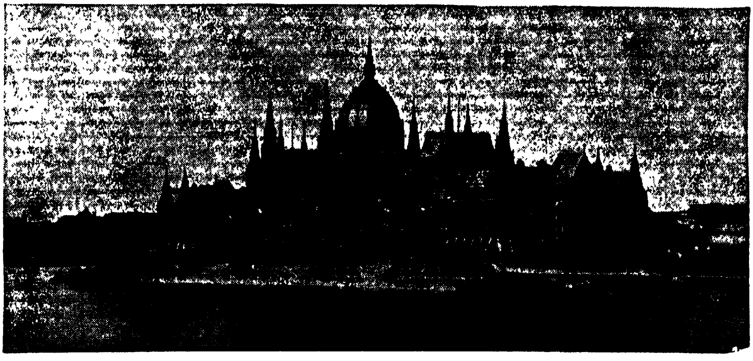
Troubles arose under Maria Theresa's son, Joseph II, who treated the Hungarians harshly; but conditions afterward became better. When the French Revolution broke out, the two countries stood together against it. But soon the newly awakened ideas of freedom and democracy began to sift into Hungary and the Liberal party, led by the

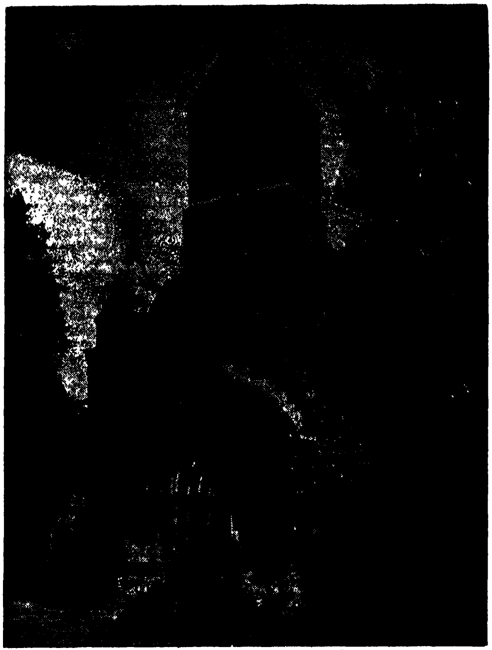
The Agricultural Museum, in Budapest. The city was the scene of fighting in World War II, and some of its finest buildings were heavily damaged.



Burton Holmes—Ewing Galloway

Parliament House, Budapest. This beautiful building, surmounted by an imposing dome, is on the Danube; it recalls the stately palaces of Venice.





Courtesy, Hungarian Consul

Old church in the Hungarian village of Jak. This building is said to date from the 13th century; it is in an excellent state of preservation.

patriot, Louis Kossuth, took action to remove abuses and to increase the liberties of the people. The efforts of the Hungarian patriots came very near success, and in 1848 Hungary became almost an independent state.

Now came a time when the Magyars showed their fatal weakness, a weakness which they considered strength. Having won freedom for themselves, they refused to grant it to the other peoples, mostly Slavs, who were under their rule. These minority peoples were deprived of their rights and even forced to give up their native languages and to use only the Magyar tongue. As a result, the Slavs united with the Austrian Government and broke down the new Magyar rule. In the civil war which took place, all the gains won in 1848 were swept away, and Hungary became subject to harsh and complete rule by Austria.

This subjection might have continued for a long time, but the power of Austria was soon broken by another force. Bismarck, in Prussia, determined to create a new German empire, with Berlin as its capital. To do so he must break the leadership of Austria, and he accomplished this in 1866, in a war which lasted only six weeks. Austria was now obliged to look to the east for her future development. She realized that she must make friends with Hungary. So was arranged the compromise (or *Ausgleich* in German) of 1867, according to which each country was to have its own constitution, a limited monarchy and separate Parliaments; but both countries were united in the conduct of foreign affairs and in the establishment of a common army and navy under one ruler, "His Apostolic Majesty the Emperor of Austria and the King of Hungary." Thus was established the Austro-Hungarian monarchy.

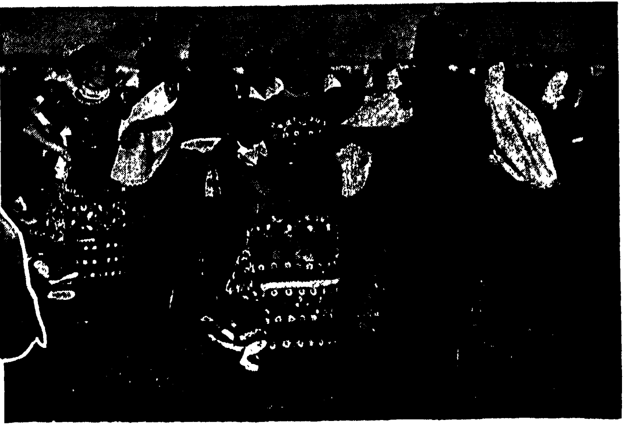
This new combined state scarcely lasted beyond the rule of one man, Emperor Francis Joseph (1848-1916). The policy of seeking domination among the Slavic states of the east was one of the main factors in bringing on the first World War (1914-18). Germany and Austria-Hungary were the chief Central Powers, and they met defeat at the hands of the Allies, chief of which were Russia, France, the British Empire and the United States.

Hungary became a completely separate and independent state after the war. But again there appeared the results of the selfish Magyar policies. The minority peoples began to break away almost before the war was over. Soon the Allied nations gave approval to these desires for a change of state, and thousands of former Hungarian subjects became citizens of Czechoslovakia, Poland, Rumania, Yugoslavia and Austria. Hungary suffered great losses of territory, which went to the countries we have just mentioned. To the proud Magyars this was a great and sorrowful humiliation. If you had visited Hungary at any time between World War I and World War II, you would have found all the flags in the country at half-mast in mourning for their departed territories. The Government functioned somewhat like a republic, with a Parliament and premier to make and carry out its laws. But actually it was a kingdom with a regent at the head, since no king was actually chosen. The regent was Admiral Horthy, a strange title for a country which had no navy!

HUNGARY JOINS THE AXIS POWERS AND LATER DECLARES WAR ON RUSSIA

Hungary was an easy field for propaganda when Adolf Hitler rose to power in nazi Germany. Hitler promised Hungary the return of all its lands. Therefore in 1940 it joined the Axis powers—Germany, Italy and Japan. In June, 1941, Hungary declared war against Russia, and in December, 1941,

IN HUNGARY, LAND OF BROAD ACRES

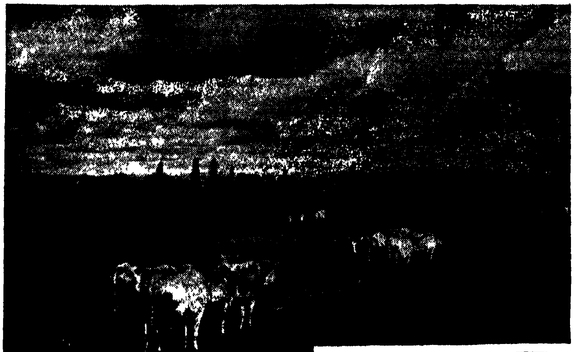


Peasants in the traditional native costume dancing at Mezökövesd.

All pictures, except lower left, Magyar Film Iroda

National dress worn by a peasant of Mezökövesd. The peasant class is numerous in Hungary, for agriculture is the principal industry of the land.

Vineyards at Villany. There are extensive vineyards in many areas of Hungary; those of Tokay are particularly renowned.



Ewing Galloway, N. Y.

Plowing with ox teams on a large estate at Batalonszeives. The great Hungarian plains are called the granary of Central Europe. The soil is very fertile, and large crops of wheat, rye and barley are produced.

The fine pigs in the foreground are browsing on the grounds of the Agricultural Academy at Magyarovar. In the background we see a group of students receiving practical instructions in the raising of livestock.

against the United States and Great Britain. Germany took complete control of Hungary in 1944, but Allied bombers and the Russian armies brought final and complete defeat. In January, 1945, Hungary signed an armistice with the United Nations, returning to Czechoslovakia, Rumania and Yugoslavia the territories taken from them with nazi aid, and agreeing to withdraw within the limits of her December 31, 1937 frontiers. On February 1, 1946, Hungary became a republic. The Communists were then strong, and they grew increasingly powerful until they had complete command of the government. Hungary became one of the Russian satellite countries, obedient to the Soviet Union. It is no longer easy to learn what is going on in this land.

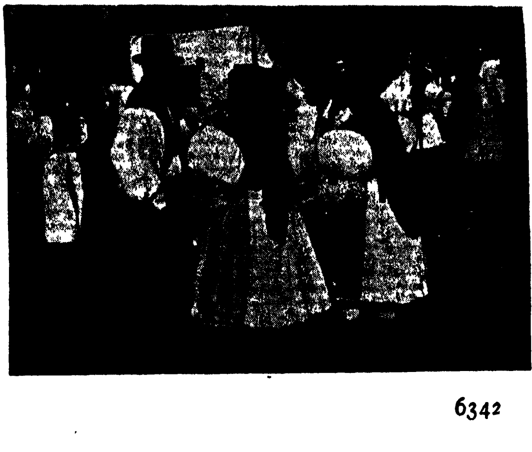
OLD BOHEMIA, NEW CZECHOSLOVAKIA

Two left-hand photos, Czechoslovakian Gov't

Young Slovakian peasant girl of Vel'ky Lom.

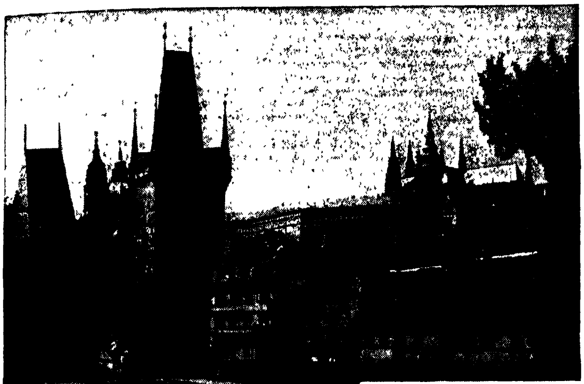
"WHOEVER is master of Bohemia is master of Europe," said Germany's "Iron Chancellor," Bismarck, in 1886. "Europe must, therefore, never allow any nation except the Czechs to rule it, since that nation does not lust for domination. The boundaries of Bohemia are the safeguard of European security, and he who moves them will plunge Europe into misery." What a surprising and tragic prophecy this was, coming from the man whom Germany's nazi chancellor, Hitler, admired and imitated.

Our study of modern Czechoslovakia must begin with Bohemia, for it is the chief state of Czechoslovakia. The others are Moravia and Slovakia. Over a thousand years ago there reigned in Bohemia the "Good King



Philip Gendreau, N. Y.

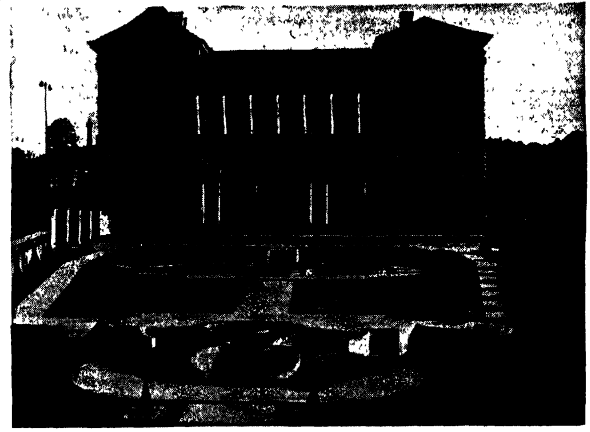
Left: national costumes of Moravia. Upper picture: a village beauty of Ungarisch Radisch, in Moravia; she is showing off her finery.



Both photos, Three Lions

Street scene in Prague, the capital of Czechoslovakia. Prague lies on the Moldau River, from the banks of which the city's buildings rise in terraces. Beyond the city are hills of considerable height. Prague is said to have been founded by the Duchess Libussa in 722.

The capital city of Prague has many fine buildings, some of which go back to the Middle Ages. One of the most imposing of these structures is the Czernin Palace, shown below. Other notable buildings include the Gothic cathedral and the chief synagogue of the Jews of Prague.



Wenceslas" of the Christmas carol. In the centuries following his time many Germans and other peoples from western Europe moved into the country.

From Luxemburg came a line of Bohemian kings in the fourteenth century. One of these monarchs, Charles IV, was the builder of Bohemia's beautiful capital city, Prague, and also the founder of Prague University, which soon became one of the centers of European learning. Charles' daughter, Anne, became the queen of England's Richard II. Queen Anne was in sympathy with the English religious reformer, John Wyclif, and Wyclif inspired the famous John Huss (1373-1415), leader of religious reform in Bohemia. Huss was put to death for heresy, but his followers fought in the "Hussite" religious wars, which aimed also at their freedom as a people.

In 1526 the Hapsburg Archduke Ferdinand of Austria became king of Bohemia, and this started a long hostility between Hapsburg rulers and their Bohemian subjects. In Prague, capital of Bohemia, in 1618, an incident took place which started the terrible Thirty Years' War (1618-48), a struggle which involved and ruined much of Europe. The incident is jokingly called the "defenestration," from the German word for window, *Fenster*. What happened was that some Bohemian nobles threw two royal governors and their secretary out of a window. The men were not much hurt, but the action symbolized the national revolt against Austrian rule; and the window is still proudly shown today to visitors in Prague. A brilliant but unscrupulous leader in the Thirty Years' War was the Austrian General von Wallenstein, whose palace is another of Prague's historic buildings. The Hapsburg rulers won the fight and Bohemia was crushed and not until 1918 did she regain her independence. Then, near the end of World War I, the state of Czechoslovakia was created. It was made up of Bohemia, Moravia, Slovakia and Carpathian Russia or Carpathian Ruthenia. Bohemia and Moravia were taken from Austria, Slovakia from Hungary, and the rest from Austria and Prussia. Most of these people were of Slavic origin, and their languages were similar.

Moravia, as far back as the ninth century A.D., was a great power under Prince Svatopluk. He united Bohemia, most of present-day Austria and Slovakia into the Great Moravian Empire; but after his death the Bohemian princes broke free and the Magyars (Hungarians) gained control of Slovakia. Capital of Moravia is Brno or Brünn, which is still the second largest city in Czechoslovakia (265,000). It is an important industrial center.

Slovakia has been under the Hungarians during most of its history. Its capital city, Bratislava (Pressburg), is beautifully situated on the Danube and is the chief port of Czechoslovakia.

Also under Hungarian rule was Carpathian Russia, which is now a part of Soviet Russia, since World War II. The people of this Carpathian area are called Ruthenians. They were harshly treated by the Hungarians, and many of them emigrated to the United States.

The leader who guided the new Czechoslovakia in its early years was Thomas Masaryk, who has been called the George Washington of Czechoslovakia. Closely associated with him for many years was Dr. Eduard Beneš. Thomas Masaryk was the first president of Czechoslovakia, and when he died in 1937, Eduard Beneš succeeded him in office. President Masaryk's son Jan grew up in the great tradition of his father and became a patriot worthy of his country's veneration. We speak of Dr. Beneš and of Masaryk again, later in this story.

Czechoslovakian Government

A skiing party on a slope of the Giant Mountains, the highest range of the Sudetic Mountains between Germany and Czechoslovakia. The highest point of the Giant Mountains is the Schneekoppe, 5,265 feet. The mountains are rich in minerals, especially iron, lead, copper and zinc. Coal is also found in considerable quantities.

The new nation of sister states prospered for twenty years, and managed to solve many of its problems. However, troubles arose with the Germans in western Czechoslovakia, especially in the region of the Sudeten Mountains, where many Germans lived. Adolf Hitler said that people of German stock were being persecuted. He used this as a pretext for conquest. Hitler's threats disturbed the democratic nations of Europe, and it was decided to hold a conference of major powers, in the hope of finding a peaceful way out of the difficulty. The conference took place in Munich, in September 1938.

At Munich, Hitler demanded that the Sudetenland be taken from Czechoslovakia and added to Germany. The representatives from England and France were forced to agree, since refusal would almost certainly have meant war, and neither nation was prepared for a war. Later, other parts of Czechoslovakia's territory were handed to Poland and to Hungary. Hitler then took another step. On March 14, 1939, he invaded Bohemia, and declared Bohemia and Moravia a German protectorate, and Slovakia a separate state under German protection. World War II broke out six months later. The nation—what was left of it—was completely crushed under nazi tyranny. The people suffered terribly during six years. Thousands of innocent persons were put to death.

An end came, in 1945, when American and Russian armies liberated Czechoslovakia from the Germans. President Beneš returned to Prague, and began to prepare a new constitution. Ruthenia chose to join the Soviet Union. The remaining states that had made up Czechoslovakia came together again, and started to rebuild their ravaged country. Then—it is not yet clear how—in 1948 the Communists gained control of the government. Democracy as a way of life was soon wiped out. Jan Masaryk fell, or jumped, or was pushed to his death from a high window. Dr. Beneš died—many people said of heartbreak because his life's work in behalf of freedom for his beloved land had come to naught. Czechoslovakia became another Russian satellite.

THE YUGOSLAVS AND THEIR HOMELAND

ONE of the effects of World War I was the complete upsetting of the group of nations known as the Balkan States.

Those nations had been Serbia, Bulgaria, Turkey, Greece, Albania and Montenegro, with Rumania disowning association with the rest, and Austria a powerful intruder. But at the peace treaties great changes were made. Turkey in Europe was limited to eastern Thrace. Rumania's area was about doubled. In south central Europe, a new nation was formed, Yugoslavia. The name means Southern Slavia.

The states forming Yugoslavia were Serbia, Montenegro, Herzegovina, Bosnia, Dalmatia, Slavonia, Croatia, Carniola and a part of the Istrian Peninsula. The population in 1940 was almost sixteen million.

Here we have a country six hundred miles long by three hundred at its greatest breadth, inhabited by people who, though separated from each other by mountain barriers, are drawn together by four main facts.

First, though stocks and religions are mixed, a large majority of the people are of the same stock, and long ago were driven into these hilly lands by invasions of Huns and Bulgars who were not near akin to them.

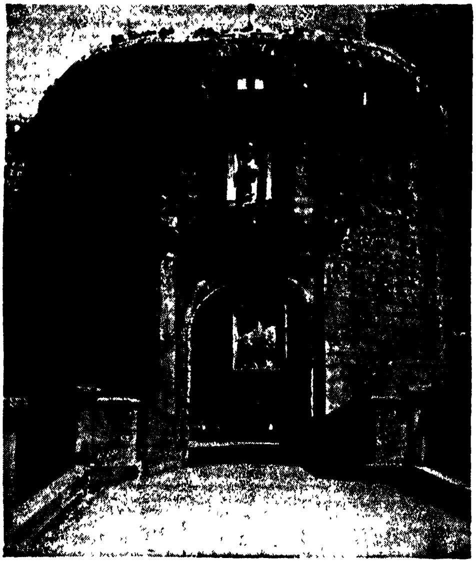
Secondly, they all retain the same foundation for their language, though separation among the hills has brought them several strong dialects.

Thirdly, Serbs and Croats and Bosnians, Slovenes and Dalmatians, had all alike suffered under the sad experience of being governed against their will, all of them by Turks, some by Magyars, and others by Austrians.

Fourthly, the lives of all the Slav people between the Danube and the Adriatic were

E. A. Pitshke from Gendreau, N. Y.

Right: old gate in Ragusa (Dubrovnik). Ragusa is a seaport town on the Adriatic. It lies at the foot and on the slopes of Mount San Sergio and its streets rise in terraces from the Corso, the chief thoroughfare. Ragusa, which was founded in the seventh century, was once a prosperous republic.



Ancient quarter of Zagreb, an important Slavic national center. This ancient city, which was founded by the Romans, lies between the banks of the Save and the foothills of the Agram Mountains.

All pictures on this page, Yugoslavian Gov't

Left: view from the main railroad station in Zagreb. The city has many fine buildings, including the cathedral, the governor's palace, the Academy of Science and the National University. Street railways connect the different districts of the city. Right: the home of the head of the Orthodox Serbian Church in Pec.

very similar. All lived by agriculture in forest lands, with valuable minerals in the hills, remote from the manufacturing world —coal, iron, copper and even quicksilver in Slavonia. But each state was hampered by mountains fencing it off from the Adriatic Sea, with Italy on the other side of the sea jealously keeping watch on the best outlets for traffic.

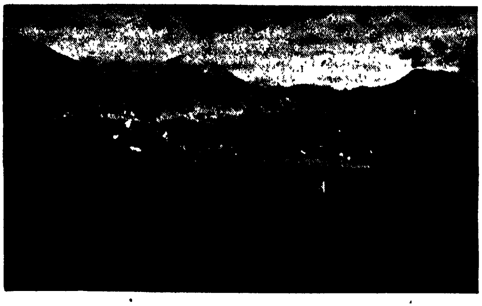
Serbia was the natural rallying center for these Slav peoples, for Serbia had already won liberty and gained by her defense of it the admiration of the world. Serbia, sloping northward from the Balkan Mountains by her river Morava, sends her produce by Belgrade, her capital, to the Danube. And, sloping southward by the river Vardar, she trades through Greece to Salonika at the head of the Aegean Sea.

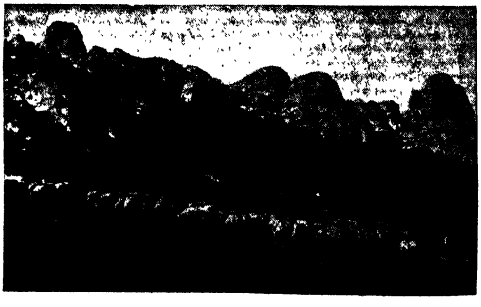
Bosnia reaches the sea more directly for its capital, Sarajevo, sends through the mountains, past Mostar, the chief town of Herzegovina, a railway to Gravosa on the Adriatic. This is the harbor of the ancient port of Ragusa.

Zara, the capital of Dalmatia, is an Italian-looking town. The principal port, Spalato, has an advantage, which Zara has not, of railways leading into the interior to Sarajevo, and on to Esseg, the capital of Slavonia, and Zagreb, the capital of Croatia. Zagreb, the principal town in this part of Yugoslavia, reaches the sea by rail both at Fiume and Trieste, and is connected with Belgrade through the valley of the river Sava.

Each state in Yugoslavia, except Dalmatia and Montenegro, is largely forest land, with swine, sheep and goats as the most numerous animals. Corn is the most used of cereals; tobacco is grown here and there; potatoes are much used as food in the lower lands. Fruit is an important product, especially plums. The only flat regions, except the part of the Hungarian plain around the Danube and the Tisza, are the central part of Croatia, which is much-flooded fenland, and the eastern part of Slavonia, a fertile corn-growing tract.

The gem of the whole country is the Alpine pasture land above the town of Zagreb, leading into Carniola. Dalmatia is bare and mountainous, and its people are largely engaged in transit work connecting the inland states with the Adriatic coast. Bosnia, which was under Turkish govern-





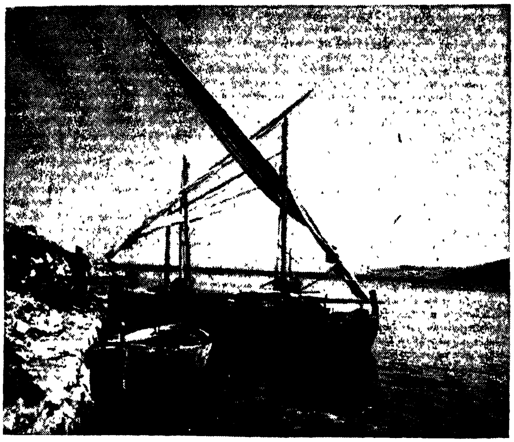
Left: Lake Bled, in Slovenia. There is a picturesque church on the island in the foreground. Right: Sheep grazing on a slope of St. Planin. In the background we see the crags which are known as the "dragon's teeth."

ment for four hundred years, is curiously mixed in religion, for, although the people are nearly all Slav stock, about a third of them are Mohammedan in faith. So, indeed, are many of the inhabitants of what was formerly called Macedonia. They have now been absorbed into Yugoslavia, as has the former little mountain kingdom of Montenegro, which always prided itself on its independence. Montenegro has a population of about 200,000. The chief town is Cetinje. Antivari and Dulcigno are ports.

The new kingdom of Yugoslavia was ruled by King Alexander I, a soldier-king who knew how to reconcile the warring factions of his state. Alexander in 1929 made himself dictator of Yugoslavia. However, he also made many enemies for himself among his own subjects. In October, 1934, while on a visit of state to France, the King was assassinated, together with the French foreign minister, Louis Barthou. He was succeeded by his son Peter, a boy of eleven years. A regency was appointed.

In March, 1941, Germany tried to induce Yugoslavia to join the coalition of states known as the Axis. The Government, under the regency of Prince Paul, signed the agreement. This meant that Yugoslavia would be on the side of Germany in the war. In a day or two the people and the army rose in revolt, put Prince Paul out of the Government and declared the boy king Peter to be actual ruler, and the agreement with Germany void.

The Germans promptly invaded Yugoslavia. The brave people of this little country fought heroically, but they had neither the strength nor the equipment to withstand the German war machine, and were soon



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Fishermen's boats along the coast of the Adriatic.

A street in the gipsy quarter of Sarajevo, in Bosnia. In this town the Archduke Franz Ferdinand, heir to the Austrian throne, was assassinated with his wife (June 28, 1914). This brought about a crisis which finally led to World War I.

A Dalmatian peasant girl and her pony. Dalmatia was the name formerly given to a Yugoslavian district on the eastern Adriatic coast. Most of the inhabitants are Serbs and Croatians.

overcome. Yugoslavia was then divided into several provinces or puppet states. Germany took the old province of Slovenia, which had many German inhabitants. Dalmatia was made an Italian province, and the Kingdom of Montenegro was re-established, with Michael, a grandson of the former king, as ruler. Croatia was also made a separate kingdom, with an Italian as king. Under a treaty signed in 1924, Italy already owned the Adriatic seaport of Fiume.

Yet not all of Yugoslavia's people were subdued. Bands of stubborn patriots made sudden attacks upon Axis forces, hiding in the mountains between raids. General Draja Mihailovich, and, later, General Joseph Broz commanded many of these bands of underground fighters. With the close of the war, in 1945, Yugoslavia was liberated and Broz (now known as Marshal Tito) became the most powerful figure in the new government. He soon had his rival, Mihailovich, executed. Tito, a Communist, set up a communist state, under the advice of the Soviet Union. Later, this friendship was broken, and Yugoslavia found itself in a difficult position, a Communist rejected by the greatest of the communist powers.

THE MOUNTAIN STATE OF ALBANIA

ALBANIA began to exist as a separately acknowledged nation in 1912.

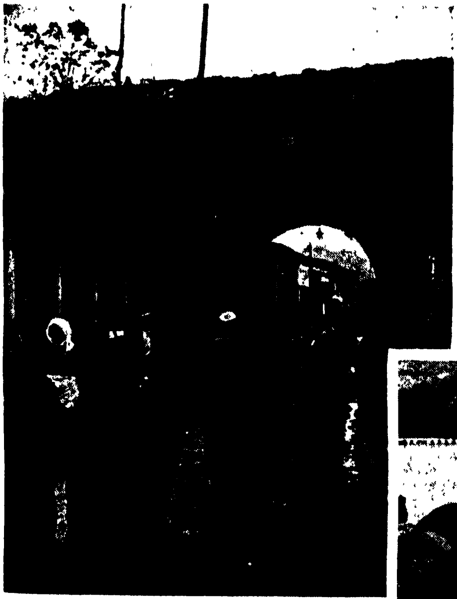
It is a mountainous land, bordered by Yugoslavia, Greece and the Adriatic Sea. Agriculture and cattle-raising are its chief occupations. The capital is Tirana, but the city of Scutari and the seaport Durazzo are perhaps better known.

After many centuries under Turkish rule, Albania declared its independence. After World War I it was proclaimed a republic (1924), but in 1928 it became a monarchy, with its president becoming known as King Zog I.

For many years Albania had been under the influence of Italy. In 1939, Italian troops invaded the country and the King fled. Italy now commanded both shores of the Adriatic, and Mussolini, the dictator, planned to launch an attack on Greece from a base in Albania. But Albanian patriots joined the Greeks and fought against the Italians and against the German armies who followed, until finally subdued by the nazi power. The Albanians suffered greatly in the occupation period that followed.

Liberation of Albania came in 1944; and in 1946 Albania became a communist republic. All natural resources, railroads, telegraphs and banks were taken by the state. When Albania's neighbor, Yugoslavia, fell out of favor with Russia, Albania also turned its back on Yugoslavia.

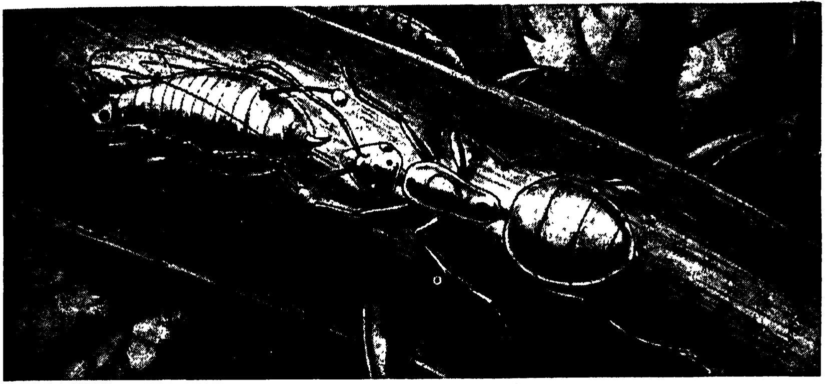
THE NEXT STORY OF ALL COUNTRIES IS ON PAGE 6440.



Photos from Three Lions

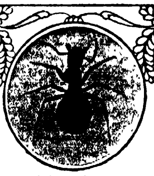
A street scene in El Bassan, Albania. The people of Albania are hardy mountaineers and they make excellent soldiers. More than half of the inhabitants are Mohammedans; there are also considerable numbers of Orthodox Christians and Roman Catholics. El Bassan is a strongly Mohammedan community and keeps up the old Moslem customs.

Natives at Valona. Valona is an Albanian seaport, protected from the fury of the Adriatic by the island of Sasseno, offshore. It is just across the Strait of Otranto from the heel of Italy.



An ant milking an aphid.

THE WONDERFUL ANT



Wood Ant.

THE ants have a certificate from Solomon for diligence and wisdom. They are perhaps the most impressive little creatures in the entire animal kingdom. Their social system is even higher than that of the beehive and in many ways startlingly resembles that of mankind.

Some of the things ants do outdistance the skill and instinctive habits of many tribes of men known to science. These insects have a knowledge of hygiene, of the art of taming other creatures and employing them for service, which is much ahead of that of untaught savages.

Some savages have no civic life, no homes, no animals, no crops. The ant is a citizen of a considerable city marvelously planned, with ordered streets and highways. It has nurseries for its young ones, storehouses for its food, quarters for its army and workers, cattle abounding in stables which are in reality strong places of confinement.

The ants know so much of the art of living together in multitudes that with a little care and patience an informed author might write a story of their life in peace and war which might pass for a description of life in a human community. They have many virtues comparable to those of human beings, but they have vices as pronounced as ours, and of the same kind. The attitude of the ant toward nearly all animal life but their own and that of the creatures which they take as slaves or guests into their nests, is one of intense hostility—if hostility is the correct term. Perhaps we had better say that they have an appetite for anything that lives, and that in gratification of that appetite they are merciless, and eat while the victim is alive and in agony from their bites.

There are more than 3,500 distinct species of ants. They live everywhere on the earth except on the highest mountains and in the regions of perpetual snow. Most of them live in the earth, though some species live in dead or decaying wood, and others build nests in trees. There is no kind of food which some ant will not eat.

Courage is the badge of all the race. It is hard to believe that they swarm to attack huge pythons which crush cattle, but it is true. The snake has no terror for enemies whose numbers are overwhelming even after thousands may have been crushed by the writhing giant. The ants win in the end and devour the great reptile. A snake is so huge and so formidable that they may slaughter it in ignorance of the wonder they perform.

A timid man in ambush may slay

an elephant or a tiger, yet flee from the uplifted fist of a puny member of his own race and sex. How, then, does the ant fare against an antagonist whose powers it may reasonably be expected to appreciate? There is no better answer than personal experience furnishes.

First, then, picture a swarming of brown garden ants. It was the day on which the young queens and drones were due to take their wedding flight—the most important day of the ant year. A series of ant cities were kept under observation by the writer. The nests were at intervals of from six feet to sixty yards and more apart. All were separate, distinct, and without any communication with each other.

THE WORKER ANTS THAT RISE EARLY IN THE MORNING

Yet all swarmed on the same date, late in the autumn, a hot day, after a cold summer. The wingless workers were out in streams early in the day, but the winged queens and drones did not begin to appear till noon had passed. The workers assisted them out of the holes in a stuccoed wall which formed the exits from the city.

Timid and unwilling, the winged queens needed repeated support and encouragement to induce them to climb up the wooden posts of the fence from which they were to take flight. They were like nervous girl-brides leaving home, and demanded the sympathy and aid of their wingless relatives. They were petted and stroked; their wings were smoothed by the jaws of their attendants, and toward the close of the exodus it seemed as if the workers grew a little fretful and gave more than one shrinking queen a nip to make her mount into the air.

Now, at the summit of one of the posts which was serving as a sort of springboard for the queens there lurked a large wolf spider. It seemed to avoid the crowded area where workers and queens were congregated. But presently one queen, unwilling to try to fly, wandered away from the general assembly, as if to find another point from which to start.

THE REVENGE OF THE ANTS ON A RAIDING SPIDER

With one spring the spider was on her, but before he could fasten his fangs in her, a worker ant one-sixth his size dashed at him. The spider retreated in alarm, followed by his little assailant. Other ants at once joined in the attack, and, like a man springing from a precipice to avoid foes on land, the spider leaped into the air, and dropped five feet to the ground, paying out a life-line of silk as it fell.

It alighted among an army of ants on the pavement. Quicker than one can tell it, the ugly creature was swarmed on by the ants on the pavement. The spider seemed to recognize the hopelessness of the fight. After one attempt to run away it crouched down as if dead. That served no useful purpose, but hastened its end. The ants rushed on it like Furies. They bit it, they turned it over on its back, and in a trice they were hauling it to their hole. It was too big to be dragged into so small an opening; its sprawling legs lay like hurdles across the portal. The ants bit off its legs, and carried the fat body in!

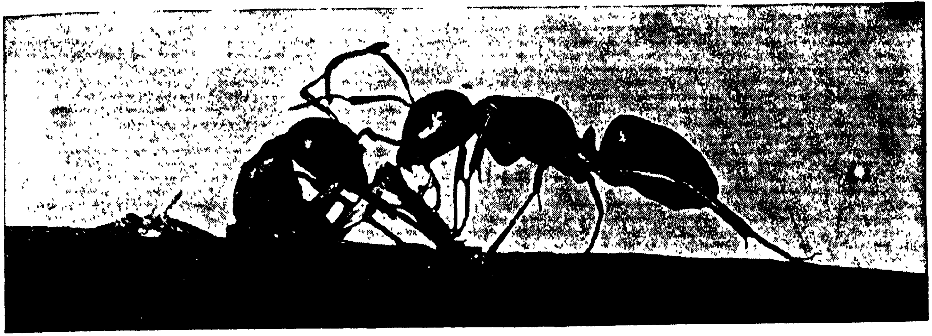
Picture the home of the ant—a labyrinth of highways, with halls and chambers, supported by pillars. There are nurseries for the babies, but as these are constantly hatching, they are of various ages. Therefore they are grouped according to the stage of development they have reached.

THE LOVING CARE WITH WHICH ANTS TEND THEIR YOUNG

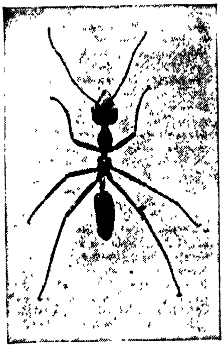
How old this wondrous city is, how old the citizens, cannot be guessed. Some queen ants live, it is known, for fifteen years at least. The worker ants, too, may live for years. In this they have a great advantage over worker wasps and bees. The activity in the city never ends. The adult ants do for their little ones what the State might do for human children: watch over them from birth, assist them through youth to maturity, and bury them when they are dead. The one respect in which the ant fails is that it does not look after the sick.

They do look after the young. The care of the workers for the offspring of their queen is unexcelled in any grade of life. It is perhaps unnecessary to say that the queen is the mother of almost the entire population of the colony. She appears to have the power to regulate the sex of her children. That is to say, she produces at the fitting season eggs which will develop into workers, which we call sexless, and later she produces future queens and drones.

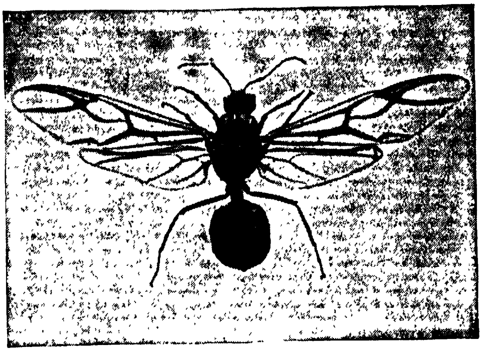
A FEW OF NATURE'S LITTLE WORKERS



Carpenter ants at work.

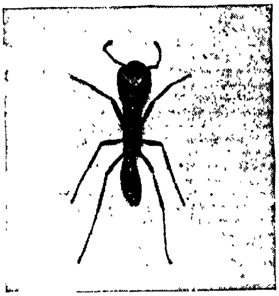


Tailor, or spinning, ant worker.



A winged female spinning ant.

Queen wood-ant.



Driver ant worker.

Red wood-ant worker.

House-ant queen.

Ants removing the body of a dead queen.

A swarm of busy ants.

Practically all the citizens are her children, yet not quite all. The so-called sexless workers have the power, in time of need, to lay eggs, but, so far as has been discovered, these eggs always turn into male ants, the drones. When food supplies are scanty the queen ant, like the queen bee in similar circumstances, is likely to produce more male eggs. Generally she first lays the worker eggs, then the queen eggs, and finally the drone eggs.

This order is necessary, for the more workers, the greater is the supply of food brought in and the larger the staff of little workpeople to carry on the labors of the ant community. Let us imagine the summer hatching season in progress. The egg becomes a grub—legless, wingless, helpless. It is affectionately fed by the workers, who pre-digest the food for it in the same way as the bees do for bee larvæ. In turn the workers seem to like a fatty substance which comes through the skin of the larvæ, and eagerly lick it off.

Not only are the grubs fed and cleansed: they are carried about the city daily for airing and exercise. The period occupied by the grub stage is variable, but probably in no case more than two or three weeks.

THE SILKEN JACKET THE ANT GRUB MAKES FOR ITSELF

At the end of that time the ant grub of certain species spins itself a vestment of silk—a cocoon in which it lies foodless and inert while undergoing the change from a writhing maggot into a perfect ant. Three weeks is about the average term for this transformation. Throughout that time the workers tend the sleeping creature with all the loving care which they displayed to the ravenous grub.

Daily it is visited by its careful attendants. It is even carried up to an outlet of the city and screened by some sheltering stone. There it may derive the advantage of sunlight without the danger of observation. It is strange that these little people of the dark underworld realize more than we do the importance of sunlight to growing life.

At last the slow wonder is achieved, and a little ant is ready to issue from the silken shirt which the grub wove. But it cannot do so unassisted. The workers must aid in the removal of the imprisoning robe.. It is a full-sized ant that creeps from the cradle bondage, for all development as to size takes place in the hungry grub period. But the new ant is not yet fit to hold its own with its enemies in the outside world.

It must still be fed and nurtured by its elders; it must be taught its duties in the nest, like a new boy learning the regulations at school. For two or three weeks this probation may last, in which time the new ant is housemaid, scavenger, builder, nurse, all things by turn. Finally it joins the hunters and goes out into the world to battle and capture food.

THE FEEBLE DRONES WHICH LEAVE THE NEST, NEVER TO RETURN

With the drones and queens the process is different. The queens do no work except egg-laying after workers are born. The drones are rather feeble folk, and cannot entirely feed themselves. On swarming day out they go to meet queens from other colonies. They never return. They are destroyed by birds or by other insects; winds and rains sweep them in multitudes to destruction, or they fall wearied at night to perish.

The queens, however, return to earth and either enter an old city where they live peacefully with the reigning queen, or else they start a colony of their own. Whichever the course, they have that one flight and that alone, for the first thing they do, on regaining the nest, is to break off their wings. Should a returning queen fail to do this, the workers break her wings off for her. There is no second flight for a queen, unless it be on foot to change her nest with all her children about her.

Such an occasion is deeply interesting to watch, for we are able then to realize what a value the ants set on child life. Next to the queen herself, if indeed second at all, they rank the eggs and babies foremost in significance. No wandering tribe of men and women marching across a continent ever showed more devotion to their children than these puny insects show for their eggs and infants.

THE ARMY OF FOLLOWERS IN THE TRACK OF THE MIGRATING ANTS

Such a migration is marked by an unexpected sight. The colony has a host of camp-followers—various insects which are the living treasures of the owners of the city. There are many beetles, there are lesser breeds of ants, there are multitudes of aphids.

These camp-followers go where the ants go. The willing ones are either parasites or pets. More than five hundred species of insects are known to inhabit ant nests. Some of them are kept because they diffuse odors pleasant to the senses of the ants. Some yield sugary secretions; some are unmistakably pets, things the ants rejoice to keep, feed and guard, just as boys love to keep rabbits, birds and caterpillars.

But the greatest wonder investigated up to now is in relation to the aphids. What do plant-lice, creatures of the foliage and the open air, down in the gloomy recesses of an ant city? They are the cattle of the ants, the milch cows. As we all know to our cost, the plant-lice emit a sticky solution, which we call honeydew. This is so plentiful when the plant-lice are well fed that not only does it impart a glutinous sheen to the leaves of trees, but actually drips to the ground.

That honeydew is the dearest food treasure of the ants, and to get it they practice arts which we could not believe, had observation not been a hundred times confirmed. The ants take the aphids prisoners, carry them down into their cities, and there pasture them out on the roots of some plant, such as grass. Some kinds of ants build a sort of shed over aphids on branches of trees. However, most species do not go to so much trouble, but merely "milk" the aphids where they find them, if at all.

HOW THE ANT CITY MAKES SURE OF ITS CATTLE SUPPLY

The aphid makes its return in the form of honeydew, which it surrenders to the ant at a touch of the latter's antennæ. We may see this done in the open, where an ant approaches a plant-louse on a roseleaf and there gently milks it, as it were.

But the plant-lice, though prolific, are short-lived. How is the supply to be maintained? In the autumn certain ants collect the eggs of aphids laid on plants in the open, carry them down into their subterranean nurseries, keep them there all winter, and when they hatch out in the following spring, transfer the baby aphids to the air and restore them to the food plant on which they will grow to strength and sufficiency of honeydew.

That happens in abundant instances in the North, so we are prepared to find ants in warmer lands extending the same type of prevision to the products of the field. The agricultural ants of Southern Europe, and of various places in the New World and elsewhere, garner grain for future use with superb skill.

THE UNDERGROUND BARNS WHERE FOOD IS STORED FOR THE WINTER

They have been credited with too much talent. They have been said to set the seed and reap the harvest. What they actually do is to bite down, in the vicinity of their cities, all vegetable growth save the grass known as ant rice, which forms a large part of their food. This gives unchecked opportunity to the ants' cereal. When it ripens they carry the seed down into their barns and store it against the coming of winter.

Buried grain germinates with heat and moisture, but not where an agricultural ant buries it. With supreme wisdom the little husbandmen bite off the radicle, the life-germ of the grain, so that it cannot grow. But it is found that when they desire sugar they allow a certain proportion of their booty to begin growing. Then they eat the transformed product, while still maintaining an ample reserve of the dry sterilized grain.

A new vista of perplexity opens here—the relations of ants to the plant world. Eager as they are for flesh food, the majority of ants dote on honey in all its forms, and this craving makes them robbers where they contribute no valuable return. Smooth-bodied and hairless, they are not pollen-carriers, as are the bees, so plants arm against them. The subject belongs more to botany than to the animal world, but the student of the ant must devote attention to it in the proper quarter.

THE FIERCE ARMIES THAT PROTECT AN ACACIA TREE OF AMERICA

We must, however, include here one amazing instance of mutual accommodation between trees and ants. The tree is a certain South American acacia, notably thorny and forbidding of aspect, yet generous of leaf, irresistibly alluring to hungering herb-eaters.

Now, each of those threatening thorns on the acacia is simply the outward defense of what is a fortress within, garrisoned by ants! The thorns are hollow and are inhabited exclusively by a specially virulent species of ants, which, when the tree is menaced by man or animal, dash out, swarm on him or it, and bite and inject poison as if they loved their task and their tree.

How does the tree lure the ants to itself? The homes it affords are well enough, but if the ants had to roam in search of food the defense would be intermittent, and disaster might befall while the guardians sought their daily bread abroad. So the food is grown at home.

Each leaf of the acacia exudes honey in a generous stream, so that the garrison is furnished with meat, drink and abode all on the same tree, and on the same terms as those on which the old man-made cities of Europe and the feudal castles and estates of medieval times had their constant armed defenses. Flowers spread their charms for the delight of bees, but this extraordinary tree is modified entirely for the reception, housing, victualing, of nothing but ants, and entertains its armed retainers in myriads.

THE RETURN OF THE RAIDERS UNDER THEIR PARASOLS

One of the functions of these acacia-haunting ants seems to be to keep off marauding ants of another species, the famous sauba or parasol ants, as they are called. Their second name is derived from their habit of cutting out sections of leaves and carrying them upright, like umbrellas, over their heads back to their own nests. In the wilds their practice is harmless, for though they strip a tree, recovery is easy in that generous climate. The danger arises when men advance into the ants' territory and there seek to grow coffee, oranges and other products of civilized life.

Here these leaf-cutters are a destructive terror to the grower. He has no ants like those possessed by the acacia tree. So he denounces the parasol ants, but the naturalist admires and marvels. There is reason to do both. The saubas are well organized. Included in their ranks are not merely ordinary workers, but huge-headed soldier ants with terrific biting jaws.

When a leaf-cutting foray is coming, the soldiers marshal the workers into ranks and guard the flanks, where they attack and devour any enemy they may meet. In the same order the procession moves home with the booty. Enormous nests are made and stored with the leaves brought in—cities nearly forty feet in diameter and spreading out below ground. Here are stored the stolen leaves. After treatment by the ants, the vegetation throws up a mass of fungus, which forms the food of the ants. Some naturalists believe that the ants cultivate the fungus. We do not know. It is certain that the fungus grows after the ants have gnawed it; we have no proof that it grows without such treatment.

THE DIVISION OF LABOR PRACTICED BY THE SAUBA ANTS

There is a scientific division of labor among the saubas, in the open as in the depths of the city. Multitudes scale the trees and drop the severed leaves to the ground, where waiting workers pick them up. This difference of tasks seems general among the hundreds upon hundreds of species of ants whose ways have been studied. Some of them have a perfect method of using effort for the common good.

We see them transporting grains of corn. Three or four ants to a grain carry prodigious burdens in proportion to the size of the bearers for half a mile and more. Others carry worms in the same way. It takes three ants to support and move the particular worm they favor. To do the work the three line up one behind another. Each straddles the worm and grips it with its jaws. Then they march. Under a good magnifying glass the bearers and their burden resemble very much the great vehicles which we employ for carrying tree-trunks.

THE LIVING STOREHOUSE IN WHICH THE ANT KEEPS ITS FOOD

Nature has played her part in enlarging the ability of the ants to divide labor. Nothing stranger in the world is to be found in this direction than the honey-pot ants. This is a Mexican species in which certain of the workers remain always in the city and act as animate honeycombs. The workers bring in their nectar and calmly pump it down the throats of the honey-pot receivers. The sweet fluid passes down the gullet of the receiver and into the strangest of all stomachs. It is like a tough little balloon in which all the natural digestive organs are present, but ridiculously reduced, simply to permit of an enormous extension of the crop for the storage of the honey.

The ancients imagined a Tantalus whose fate it was ever to have luscious food and pleasant drink brought almost

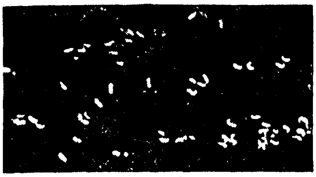
AT HOME WITH THE ANTS

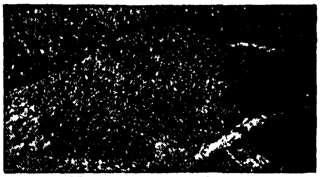
Ant hill section.

Nest of an Australian ant.

Nest of a Malaccan ant.

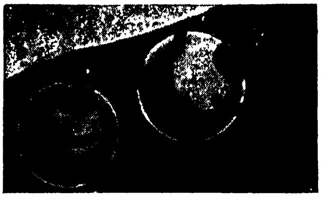
Tailor ant's nest.

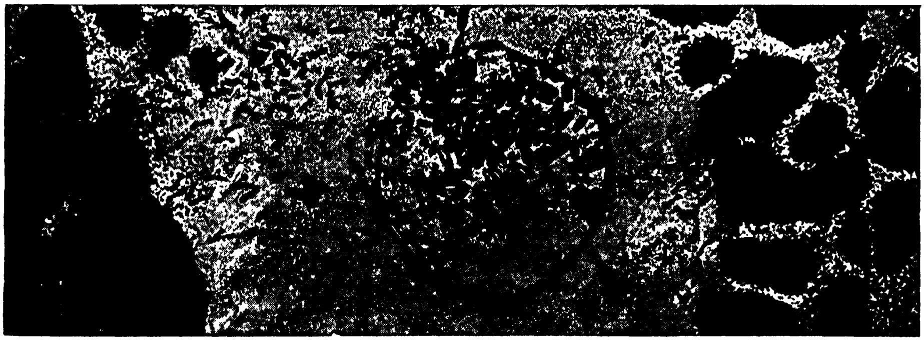

Inside the wood-ant's nest.

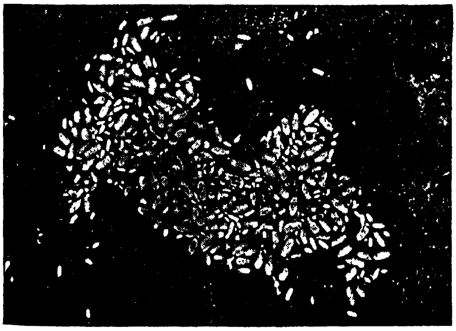

Nest of the wood-ant.

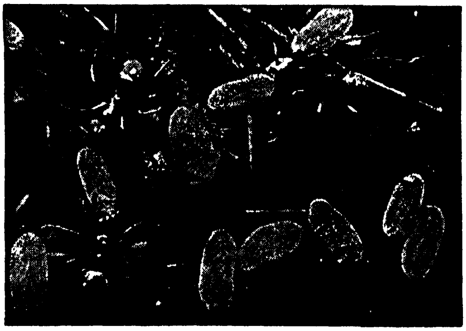
A stable of ants' pets.

Parasol ants carrying leaves.


Mexican honey-pot ants.


Meadow-ants at home in their nest.


Pupæ of the black ant.


Ants carrying cocoons.

The pictures on these pages are by Messrs. Collins, Paul Griswold Howes and others.

to his lips but never quite within reach. The ant Tantalus is filled to bursting with the spoil of innumerable flowers, but is not permitted to enjoy more than the barest amount of sweetness; it must receive at command and give back at a summons. The ants give, the ants take away, when they need honey.

That is the most curious adaptation we shall find; but there are others in the line we have considered, of blended forms and endeavor in the ant tribes such as Solomon never knew. Some species have engineers which, when the workers move out, construct tunnels for them so that they make great marches in search of prey, as well protected from observation as the trains in our subways.

THE FIERCE ATTACK OF A HOST OF BLIND RAIDERS

Others, of the aphid-loving kind, run tunnels up the trees in which the honey-yielding cattle live, and bring them down into the citadel by these routes, or coolly wall in the aphids where they are and keep the tunnels for their own lines of communication.

Terrible to all other life in the vicinity are the operations of the larger and fiercer ants. The Eciton ants are notorious for the extreme severity of their attacks on all other living creatures within their range of action. They clear their line of march of every living thing as if a flame had swept it. Birds and beasts, every type of insect, are attacked and eaten piecemeal. Even creatures which feed on ants are overwhelmed by sheer weight of numbers.

Human habitations are not proof against them. The ants swarm through them, clearing every particle of food, every rat and mouse, every spider and fly, all the vermin which negligent natives tolerate in their homes. They are common in tropical Africa and South America.

The curious thing is that these ants are blind. They had sight once upon a time, but their habits of dependence on touch and smell have led to complete loss of the sense of vision. In spite of this they are quite efficient. Perhaps our northern ants, which obviously rely little on sight, will in time lose their power of eye, too. Already their ocelli, the three little eyes which they carry in addition to the two great many-faceted eyes, have practically lost their power of seeing through lack of use.

THE TERRIBLE ARMAMENT OF THE SLAVE-RAIDING ANTS

That is not the only loss that ants sustain. As we have already said, the social life of these insects resembles human civilization in its worst vices as in the highest of its virtues. It is but a short step from the domestication and imprisonment of plant-lice and other insects to a regular system of enslavement. Many species of ants are confirmed slave-raiders, the redoubtable Amazon ants especially. They are formidably armed with great biting jaws, and their habit is to send out scouts to adjoining colonies of ants of lesser force. Then, at a given signal, they sally forth, thousands strong, to steal flesh and blood at whatever cost.

Added to their fighting qualities are impressive military abilities. They attack the doomed nest with a run and carry it by main force; or they surround it, place guards at every exit, then throw in what we must believe to be parties of picked fighters. Out come the rightful owners and battle is joined. The defense is hopeless. Soon the ground is littered with a horrible wreckage of ants bitten in two or torn to pieces. But while the fighters are thus wrestling in a death-grapple the raiders within are at the nurseries.

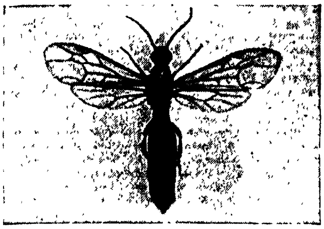
THE LAZY LIFE WHICH FOLLOWS A SUCCESSFUL RAID

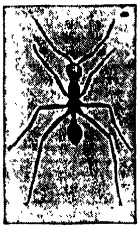
Out they come, each one bearing an egg or a larva. When the home has been denuded of its infant life, the column is re-formed and the living booty is carried back to the Amazon city. To what end? Simply that the larvæ, waking to adult life in a hostile land, may know no other condition, but meekly accept bondage. They become the slaves of their captors.

There never was a condition in life which slavery did not undermine. Greece and Rome became weak through their dependence on slave labor and slave soldiers. The ancient empires of the East rose and fell in tides as slaves were many and faithful or few and unstable. Most of the dynastic tragedies in modern Oriental lands have sprung from the plots of slaves in the seclusion of the royal palaces.

And the greater the success of the raids of the slave-making ants, the worse it is in the long run for the conquerors. They cease to forage for themselves, leaving the task to their captives. They abandon habits of cleanliness; they neglect even to feed themselves. Everything is done for them by their tireless slaves.

When the home has to be changed, the slaves must carry their masters, helpless as larvæ. Left to themselves, these conquerors, who slew thousands and wrecked strong places of defense, now starve and die, helpless if denied the daily service of the little slave ants to keep life in them by their ministrations. Self-help for ants as for humans has still much value.

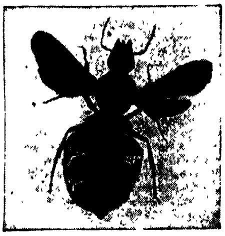

Winged foraging ant.

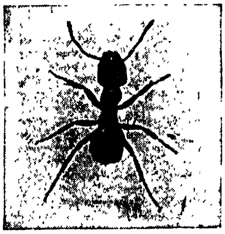

Foraging ant worker.

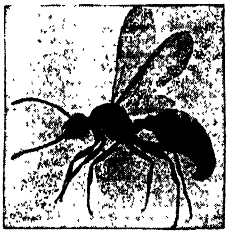
Sauba ant worker.

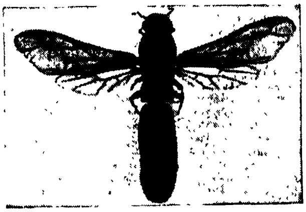
Winged sauba ant.

Carpenter ants at rest.

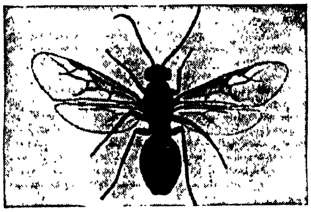

Meadow-ant princess.


Brown meadow-ant worker.


King meadow-ant.


Winged driver ant.

Slave-making ants at war with black ants.


Winged wood-ant.

Such a decline in skill, ardor and independence as we see here is the more striking because it comes about in the life, not of a species, but in that of an individual colony, an individual ant. Every ant born into the world appears to be amply equipped with gifts and cunning. We are always learning new things about these creatures, increasing our astonishment and sense of reverence.

For example, most of us were surprised in the autumn of 1922 when a great French naturalist returned to Europe from Indo-China to reveal a supposedly new species of ants to the French Academy of Sciences. The soldiers, enormous creatures, bear on their heads great hollow horns through which, when attacked, they eject poison gas, a vapor of formic acid.

Four months later England had as great a surprise. Keeper Brow of the London Zoo's insect department was cleaning out a nest of common wood-ants when lo, the ants began to bombard him with what seemed to be like the tear gas which was used during the World War! With streaming eyes he made tests and found that his charges were deliberately fumigating him with vaporized formic acid, after the fashion of the Indo-Chinese ants. He found that the species can discharge their irritating gas to a distance of over eight inches, about thirty times the length of the ant itself.

THE PROFOUND WISDOM WHICH RESIDES IN A TINY HEAD

If the old writers of fables which formerly served for natural history had known but a little of the ways of ants, what a literature of the impossible they would have added to the common stock of travelers' tales.

But they could not have told anything much more wonderful than the truth. Their methods of communication, their memory, their cunning and skill are all mysteries to us still. We cannot imagine how such profound wisdom can reside in so tiny a horny head. Let us finally group one or two feats in order to increase our respect for these little people.

There were some ants which for several days climbed down a string to a jar which contained sugar. Presently they ceased their journeys, yet got the sugar. Only three or four ants made the whole trip. They brought grains of sugar up the string and dropped it to a ledge below, where the bulk of the ants waited to carry it off to their nest.

Then there was a tiny company of wood-ants which sought to get a great horny beetle home to their larder. It was alive and resisting vigorously, but it moved in the direction the ants desired. Two were in front hauling, and two were behind pushing, but as the ground was rough and the beetle's great legs waved and clutched, one could not understand how the tiny quartet were managing their huge burden. The mystery lay beneath, unseen. Underneath was a fifth ant, supporting the weight of the enormous body on its own.

THE WONDERFUL CLIMB OF A COMPANY OF ANTS

Best of all, perhaps, there is Mr. William Beebe's picture of a great company of fighting ants struggling out of a five-foot pit. They had cleared it of life—beetles, other ants, spiders, grasshoppers, frogs. The way up with their burden, he computed, was as difficult as if we had set men, each carrying a 200-pound weight, to scale a perpendicular cliff 1,200 feet high.

It is a fascinating story, the way they did it, five columns strong. Most of them were heavily laden, but they had disciplined contingents thrown out to pick away loose grains of sand in the path, to grip with feet and jaws and form living anchorages to which the toiling climbers could hold and climb over where places were smooth and treacherous.

But at the top of the ascent, the cliff, absolutely bare and slippery, overhung. Only a solitary ant was able to get up; the rest stayed, apparently defeated. But were they? No. The one successful ant was met at the top by numbers of other ants of the same tribe. There was a hurried consultation between the newcomer and the rest. Then there followed a rush of ants to the edge of the cliff. They formed themselves into a living mat, holding together one to another. Each succeeding line of ants went lower and lower, as bees hang down in a hive when about to form wax for their close-packed cells.

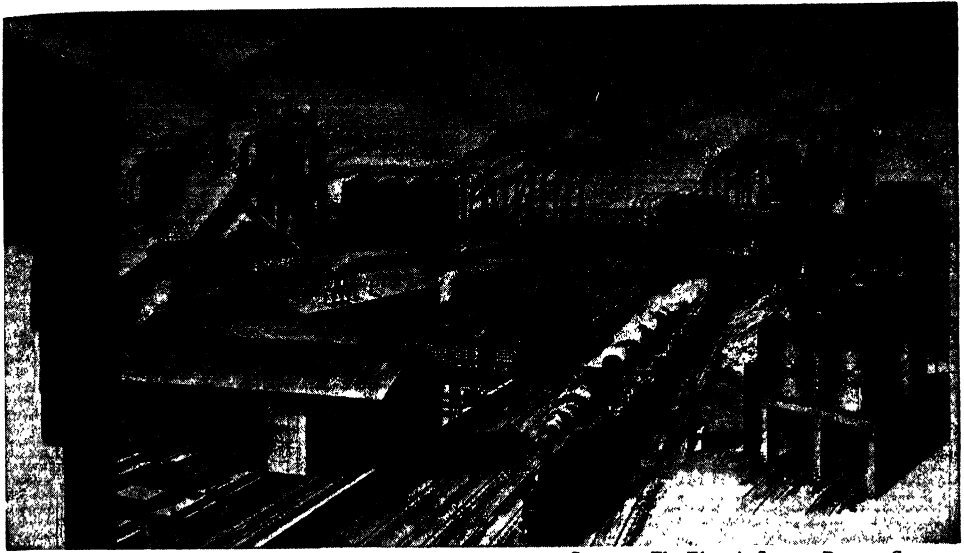
THE LIVING TUNNEL WHICH LED THE ANTS TO SAFETY

The living curtain hung down several inches, when the lowermost ant with great excitement reached down its tentacles and touched the foremost ant of the column halted below. At once the ascent was resumed, aided by the ants hanging from above. The process was a sheer marvel of skill. The lower ants could come up only over the bodies of those hanging down. Since they were so heavily burdened, this was difficult. So the hanging ants grouped themselves circlewise. They formed themselves into a tube. And through the centre of this tube, this tunnel of living ants, the burden-bearers from below, including one which hugged a morsel of frog, climbed up to the table-land above. Such marvelous things these insects do.

There is still much to ponder and perceive in the way of an ant. With its great achievements, its high efficiency, its affection for its own, its love of play, its entertainment of dependents of other genera, with its limitations and native vices, it ranks foremost in its claims on the interest of everyone who has the gift of imagination.

Among the ants we find brigands that rob those weaker than themselves. There are other ants that steal from a larger and richer species. We find evidences of co-operation between species. Sometimes their galleries open into one another, but they keep entirely separate except when attacked. Then both join to repel the enemy. There is a species of ants in New England and Canada which seems to work for a larger species in return for food. They are not slaves, for they have their own nests and raise their own broods. They are "paying guests."

THE NEXT STORY OF ANIMAL LIFE IS ON PAGE 6417.



Courtesy, The Electric Storage Battery Company

Great industrial centers, with land, capital, labor and the enterpriser in co-operation produce much of the world's wealth. Feathers of smoke pouring from many factory chimneys usually tell a story of prosperity in a city.

THE DISTRIBUTION OF WEALTH

ECONOMICS is the social science concerned with the production, consumption, exchange and distribution of wealth. In the article on the Production of Wealth you read that four things go into its making—land, labor, capital and management by the enterpriser. These are called the factors of production. Now we shall learn how all this produced wealth is shared by those who labor, those who own land, those who own capital and those who bring together land, labor and capital, and set them working. This is the problem of distribution.

In some cases a man labors on his own land, and uses only his own capital. There are many small farmers who are in this position. Such a man gets his living from tilling land for himself, and his capital consists of his buildings, his tools, machines, seeds and livestock. In such a case the worker is at the same time the owner of the land, a worker on it, an investor of capital and, in addition, an enterpriser because he supplies all the managing ability which is put into the work. Thus, as combined worker, landlord, capitalist and enterpriser, he takes for himself the entire product.

There are other occupations in which a single person may be at once worker, landlord, capitalist and enterpriser. For example, a cobbler or cabinetmaker may work for himself in a little shop which he owns, using likewise tools and materials bought and paid for by himself. In such cases there arises no problem of distribution, or sharing of profits.

Almost everyone was in this group before the Industrial Revolution of the nineteenth century, which resulted in great changes in production methods. New, heavier and more expensive machines were invented for spinning and weaving which only the wealthy could buy and install in especially constructed buildings. No longer could the peasant and his wife work with a profit the old-fashioned spinning-wheel and loom in their own little cottage. It became necessary for them to go to the "factory." There they had to learn how to operate the machines, and they had to work for wages. No more did they own the work of their hands. What they created belonged now to their employer; but in giving up their independence as workers, they also gained some advantages. So it became common for the mass of the people to own neither the machinery (capital) nor the land on which it was housed;

and they depended upon wages in return for all they had left to sell—their labor.

Today a factory may be built upon land owned by another; and rent is paid to the landlord. The enterpriser then hires labor to work the machines in return for wages.

As we already know, different names are given to the shares of the produce going to the workers, the landlords, the capitalists and the enterprisers.

Wages and Salaries. Wages are the most important single source of national income. Of the 140,000,000 people in the United States, around 60,000,000 work for wages or salaries in return for their share in the production of goods or the rendering of services. There is no important difference between wages and salaries. Wage is the term applied to the payment made on a daily or weekly basis, but when payment is based on a longer period of time, as a month or a year, it is usually known as a salary.

Kinds of Labor. It is common for economists to classify labor as either physical or mental. Those relying mainly on physical effort are naturally in the first group, that of physical labor. This group is itself divided into two groups: the skilled and the unskilled. The automobile mechanic and the electrician are, for example, classed as skilled workers, while the pick-and-shovel worker is unskilled.

The mental workers fall into either the routine group or the inventive group. The routine worker, such as the bookkeeper or the store clerk, having once mastered the routine duties of the job is rarely called upon to use judgment or imagination. Those belonging to the inventive group are relatively few in number—of this type would be the accountant, the business executive, the school principal and inventors. Outstanding names in this class are those of Thomas Edison, Henry Ford, H. G. Wells and Albert Einstein.

Rent. Rent is the share going to the landlord in return for the use of land or some other free gift of Nature. In a great city where almost every foot of land is in use, it is very difficult to distinguish gifts of Nature from the work of men. In ordinary speech, therefore, we come to use the word rent as applying to any payment made for the use of land and what is built on it. The true "rent," however, is not this total payment, but only that part of the payment which is made for the natural piece of land.

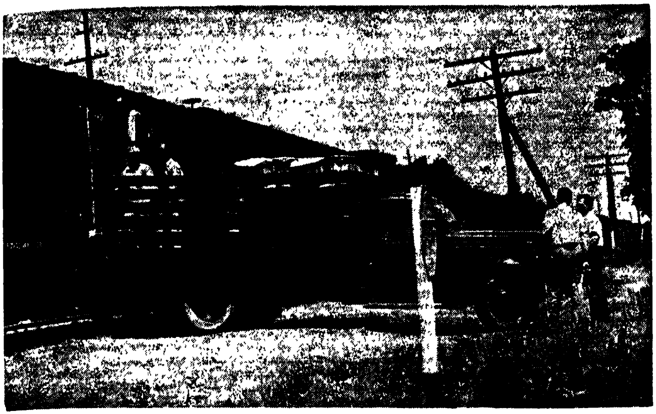
At first such a distinction may seem unimportant, but that is not really so. Let us consider the rent of a store on a main street in a large city, and the rent of a similar building in some small village. The village store "rents for" much less than a similar building in a large city. Why? The real reason is *location.* The city building is situated on a busy street and has so many more people passing by it than the one in the village that the shopkeeper can sell many more things in the same period of time in the city than can be sold in the village shop. Therefore the city merchant is very willing to pay a higher rent. You can now understand why in the large city the five-and-ten-cent stores are to be found at the busiest intersections. They are in the "high-rent" area, but the high rent is justified by the amount of business done. *Thus the economic rent is the price of the natural advantage of one site over another.*

How rents are affected by natural and other conditions. So it is in farming. If a farm has poor soil, or is poorly situated, it yields less in produce, or costs more to get its produce to market than a farm with rich soil, or one that is well located. So we see how some landlords may be able to obtain a high rent while others can get only a small one.

Let us say that a particular farmer plants the same amount of corn on two equally well cultivated pieces of land of identical size, located five miles apart. However, in spite of identical care the farmer finds at harvest time that one piece of land yields twice as much corn as the other. Assuming, as we have, that all growing conditions were the same on both plots of ground, the great difference in yield can be due only to the difference in the quality of the two pieces of land. Rent charged for the surplus grown on the better grade of land is given the name of *economic rent.*

Some land may be especially valuable because there are minerals under the surface. If coal or oil is discovered at a certain spot, mines, wells and factories will spring up on acres that were formerly worthless. Houses and shops will be built near by, to serve the people who will flock to the area. Thus, because of the natural resources the land round about will become valuable and will command a higher rent.

Again, if a railway is built through an area, rents will be raised. This is because people have been brought to the area and they have created a demand for houses. In the early days of railroad building, some landlords strongly objected to them, and tried to prevent the railroads from passing near



Fruit Growers Express

The expansion of the railroad and the development of the refrigerator car as a railroad service brought farm produce within reach of distant markets.

their properties. When such men succeeded in their effort, they robbed themselves of rent without knowing it.

Capital and Interest. People who save money (capital) may either use it to purchase things which directly satisfy their own wants, or loan it to others who wish to make use of it. Most money so loaned is used by business organizations for production purposes. Money so loaned is called capital. This money goes directly into tools, buildings and machinery, which are the real capital, of course. Now, when a person saves money and loans it out, he can not use it himself; and so a return for the loan is necessary to pay for the sacrifice. That is why money loaned must be paid for. This return for the loan of capital is called interest and is a reward for waiting.

There is some risk in an investment of this kind. When, for instance, your father loans money to the government—that is, buys a bond—he knows there is no risk. He will receive not only interest, but also the return of his money when the bond comes due. Money lent in good security to an old established business firm runs some risk, though a small one. So it is with money lent on the security of a mortgage, as it is called, of good buildings, where the lender's security is based on the fact that if he is not paid he may seize the buildings. In such instances the capitalist (the one loaning the money) has a claim on tangible property which the courts will turn over to him if the loan is not repaid according to its terms.

If everyone who saved money wanted to keep it quite safe, there would be very little enterprise. It is just because some people are willing to risk their money in hope of profit, that capital comes to be invested in business enterprise. However, enormous sums are often lost by those who take such risks.

Profits. You have learned that before the Industrial Revolution the factors of production were not separately owned. Then, it was usual for one man to own the land, providing his own labor and capital in order to produce, whether he were a farmer, cobbler, or weaver or any other kind of worker.

However, with the coming of machinery all this changed. One person would have labor to sell, another would have land to rent, and still another would have capital to invest.

To whom did the people go who had these factors to sell? They went to a fourth and new factor which had come into being—the *enterpriser,* or business man. His task it was to bring together the other factors of production in proper proportions, in order that production might be efficiently carried on. It is the enterpriser, then, who assumes the risks for the success or failure of the enterprise. He must make the decisions as to the amounts of land, labor and capital necessary in a given plant or business unit.

Who is the enterpriser today? Technically he is either the single proprietor who provides all the land, capital and labor himself; or the member of a partnership; or the stockholder in a corporation, or the business executive who directs the destiny of a great organization such as United States Steel or General Motors. The degree of risks involved varies greatly among these individuals. In every case some risk is present, and therefore each of these men is an enterpriser. The term enterpriser, however, is popularly applied to executives of large corporations.

In return for assuming these important responsibilities and the risks involved, the enterpriser is rewarded with *profit.* Profit is what is left after the costs of doing business are deducted. In the case of the single enterpriser, the man must pay to himself what it would have cost him to rent land, hire labor, supply capital and pay a manager. These are production costs.

Anything left over is *profit*. In the partnership, what is left after paying expenses is divided up among the partners as profit. In the corporation it is paid out in the form of dividends on stock.

To the economist and business man there are two kinds of profits: (1) *Necessary profits* are those required to give a man sufficient incentive to work as director of a business or industry. This incentive must at least equal what the man could earn by hiring out as an employee to some other enterpriser. Strictly speaking, necessary profits are the *wages of management*. (2) *Pure profits* are those remaining after the enterpriser pays his labor, rent on the land, return on capital invested in the business and necessary profits—all costs of production. To win these pure profits, of course, is the aim of all business men. However, for business as a whole, they are none too plentiful. Neither are they guaranteed. They may be plentiful in good times, but may disappear in periods of depressions. In such times even necessary profit may not exist.

How the Distribution of Wealth Is Determined. The proper distribution of wealth between labor's share (wages and salaries), the landlord's share (rent), the capitalist's share (interest) and the enterpriser's share (profit), is a very difficult matter to decide. In the main, the distribution of this wealth is determined by the action of the laws of *supply* and *demand.*

How Rent Is Determined. Demand and supply affect rent as they affect prices of anything else, such as shoes or baseballs. If many people must live in one place they all demand houses and, therefore, there is a big call for land at that place. This demand raises the price of the land, or the rent paid for the use of it.

Is it possible in such a case to increase the supply of land to the people who want houses? Yes, it is possible. If a building of many stories is put up, more people can live on the land than if a building of only one or two stories is erected. A railway or a bus line can make it possible for people to live far away and quickly ride back and forth to work. In this way the homes of the people are scattered and, in effect, a larger supply of land becomes available for them, in which case the rent at the busy spot may fall.

How the Returns to the Capitalist and the Enterpriser Are Determined. As in the case of the return to land and to labor, supply and demand largely determine the share of national income going to the capitalist and to the enterpriser. If, for example, as the result of an invention, a new and successful business is created, more capital and managerial ability are required. To secure this necessary capital through the sale of bonds, high interest rates will be paid, and the hope of greater profit will lure the enterpriser to associate himself with the new project. This was exactly what happened in the early days of both the automobile and moving-picture industries. But as more and more capital entered the field, and larger numbers of enterprisers sought the rich rewards, the supply of both these factors began overtaking the demand. As a result, today, the interest and dividends paid by these industries are about on a par with those paid by other major business enterprises.

How Wages Are Determined. We saw in studying prices in general how the demand for goods really means the demand for goods at a certain price. The demand for workers in practice means demand for workers at a certain wage.

The employer can not pay more than a certain wage at any one time, unless he can get greater production from the same number of workers. If still higher wages are demanded he has to go out of business.

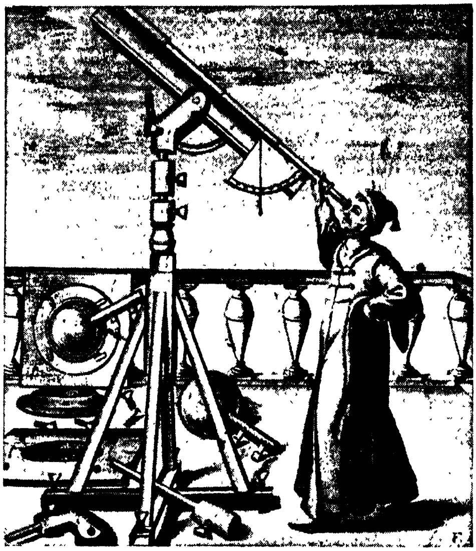
The supply of labor also governs the price of labor. If, for example, a large number of workers seek jobs in an automobile plant that already has all the laborers it needs, the employer may be able to reduce wages upon threat of dismissal. This gives the enterpriser an advantage over the worker which can be modified only by good feeling and justice, or by the workers uniting.

The labor union is a society of workers banded together to secure for themselves the highest wage which the profits of their trade allow. The union, if it does its duty, will see that its members are not underpaid, and yet it will not be so foolish as to demand a wage higher than the industry can pay. However, just as the employer is often a bad judge of the justice of his own case, so the unions are not always wise or fair in their demands upon the employer. Thus occasional quarrels arise about the distribution of wealth, and there are strikes and lockouts. However, the world is slowly learning that there is no problem which common sense and good will can not solve.

By GRAEME O'GERAN.

THE NEXT STORY OF OUR OWN LIFE IS ON PAGE 6593.

The ASTRONOMER'S WONDERFUL INSTRUMENTS



The Bettmann Archive

An old-time astronomer looks up into the heavens.

ONE of the most interesting and inspiring of all stories is the long, exciting and often beautiful tale of man's quest for knowledge. Wisdom and knowledge are of many different kinds, or branches; and different kinds require different methods of approach. The philosopher, for instance, does not use delicate and complicated instruments to help him to his conclusions. He could not, even if he had the most perfectly accurate scales, measure human thoughts and values by mechanical means. His material comes from his own reflections and those of others, and perhaps largely from his own heart. The astronomer, on the other hand, starts with purely objective material, with hard, cold facts, not with speculative data. Later, after he has obtained his facts, he may speculate. Theories are the result of speculation; they are actually scientific guesses, but they must be based on facts already known and observed.

It would seem that the astronomer has chosen for himself a hard job. Most of the material with which he deals is so far away that he can not even see it. The explorer may travel out to visit the strange worlds he wishes to describe. The astronomer has no such chance. The nearest of the worlds he studies, the moon, is, on an average, about 240,000 miles from the earth. The nearest of the stars beyond the sun is nearly twenty-six trillion miles away, and here our imagination begins to falter, for we have entered the celestial realm where distances are so vast that enormous stars much larger than our sun appear as tiny points of light, even when viewed through powerful instruments.

Nevertheless the astronomer tells you with some confidence what the stars are like, how large they are, whether they are comparatively hot or cold, what they are made of, how fast they are traveling and in which direction. How does he know about these things? How can he possibly have learned so much and "so far"?

The answer to these questions is simply that the story of astronomy is the story of wonderfully accurate and delicate instruments which astronomers have devised in the last few hundred years. The story of astronomy is also the story of light, for it is only as we construct instruments to gather and analyze light, the sole messenger which can come to us from outer space, that we learn about the universe which stretches out in every direction like a vast and endless sea.

In this vast sea of space which surrounds the earth, anyone with good eyesight can see at night several thousand tiny points of light which we call stars. At one time the average person can probably see about 3,500 stars. There are about 9,000 in the entire sky, of which we see less than half at any one moment. But the stars which we can see with the naked eye are only a beginning. We realize now that in our own Milky Way Galaxy, which is only one of perhaps billions of systems like it, there are many billions of stars. In order to see and study the celestial universe, most of which lies beyond the range of naked-eye vision, the astronomer has invented ingenious and powerful instruments "to bring the stars down to earth." Let us see how he has gone about this problem.

In 1608, nearly three and a half centuries ago, a Dutch maker of spectacles, Jan Lippershey, constructed almost by accident a wonderful small instrument which made far objects seem closer, and dim objects clear. He made this first telescope by placing two spectacle lenses in a long hollow tube through which he looked at distant houses and people. According to the story that is told, it was just by accident that Lippershey happened to put the right two lenses together. He never did anything of importance with his little instrument, the first telescope.

A model of Sir Isaac Newton's original reflecting telescope.

The word "telescope" is an interesting one —from the Greek word *tele* meaning "far," and *skopein* meaning "to watch." In other word, a telescope is a "far watcher," exactly the right name for it.

In 1609 or 1610, a famous physicist in the city of Florence, Galileo Galilei by name, heard of Lippershey's discovery, and set to work to make for himself a telescope which he could use in the study of astronomy. We are told that he used a piece of organ pipe and two spectacle lenses. With this crude instrument he peered at the sun, and found dark spots on its brilliant surface; he looked at Saturn and thought it a peculiar planet with "ears" or "wings." His telescope was not good enough to show him that these "ears" are really rings around the planet. Galileo observed the mountains and craters on the moon, and the four large moons, or satellites, of Jupiter, which have ever since been called the Galilean satellites. His telescope was not strong enough to show him the other moons of Jupiter.

Galileo's telescope made a great sensation in his day. People from far and near flocked to have a look through it. John Milton, the English poet, was one of Galileo's visitors, to see the strange "optik tube." Galileo's first instrument magnified objects three diameters. (A telescope's power to magnify is figured by diameters.) Galileo later made a telescope with the power of eight diameters, and then one that magnified thirty diameters.

With Galileo's invention of the astronomical telescope began a new era in astronomy and in man's knowledge and understanding of the heavens. Suddenly the universe had expanded, stretching out in all directions; and man found himself in possession of a magic arm long enough to bring down to earth sun, moon and stars, the very vault of heaven itself. From that time on, for more than three centuries, the astronomer's main concern has been to improve the instruments that help him to see, to collect the faint light of the stars in his mirrors and his lenses, and to analyze the secrets of the stars.

There are two main types of telescopes, the refracting telescope and the reflecting. We have traveled a long distance from Galileo's tiny "optik tube" to the great forty-inch, the largest refractor in the world, at Yerkes Observatory at Williams Bay, Wisconsin. And it is a long jump indeed from the small reflecting telescopes of Sir Isaac Newton's day to the gigantic 200-inch at Mount Palomar near San Diego, California.

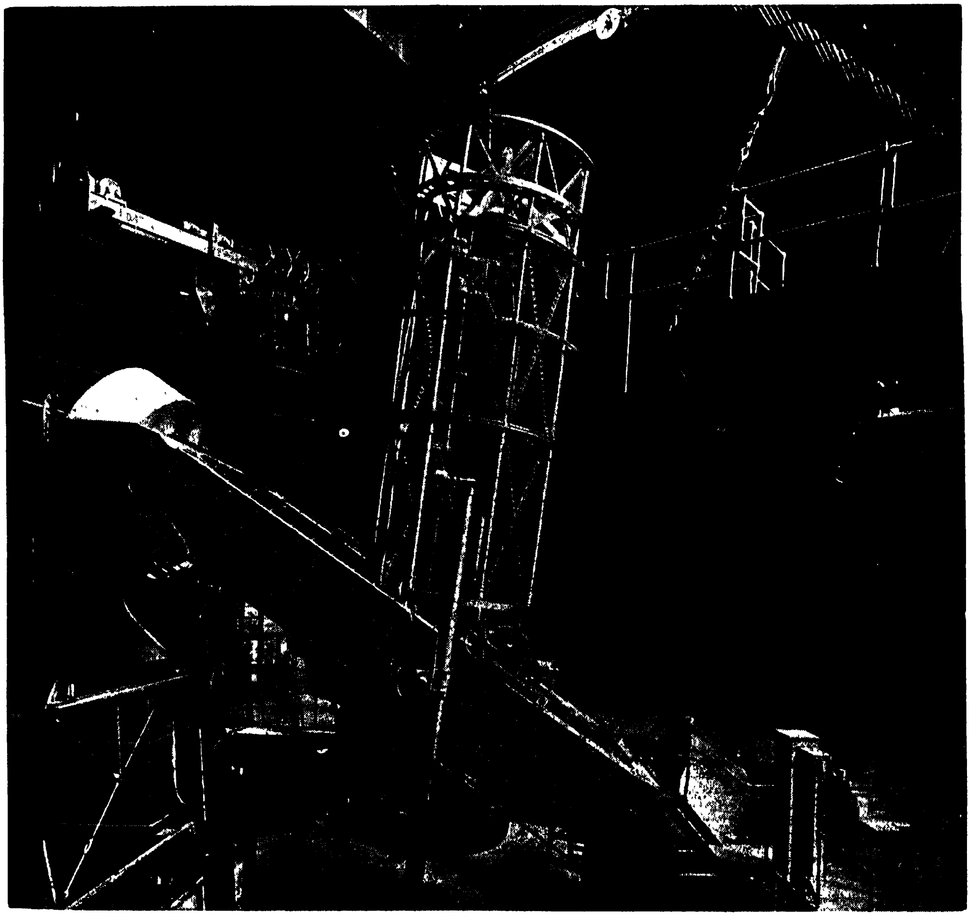
HOW WE CAN "SEE" A STAR THROUGH A TELESCOPE

The refracting telescope is, in its simplest form, a tube with a lens, called the objective, at one end, and an eyepiece at the other end. The objective is a convex lens, that is, a lens that curves outward. The rays of light from a star or other body strike the lens and are carried through it, and come to a point near the other end of the tube, forming an image. The eyepiece magnifies the image. The eyepiece is mounted in a sliding tube which can be adjusted to fit the observer's eye, in somewhat the same manner as in opera glasses or binoculars.

The eyepieces of a telescope are changeable, being of different magnifications. High magnification can be used only when the *seeing* is good. Now what do we mean by "seeing"? Let us explain this term.

The earth is surrounded, as everyone knows, by an envelope of air—a mixture of gases which we call the atmosphere. You have seen what happens in the atmosphere when its different layers are variously heated. If you look ahead of you along a hot road in the summer, you will sometimes see a shimmering and wavering of the air just above the road. Or if you sit before a window under which there is a hot radiator, you see the air above the radiator wavering and moving in the same way. This is due to the unequal heating of different layers of air. When you look out to objects beyond, through these layers, the objects appear to be distorted. The astronomer often notices this same effect in the atmosphere through which he must look to see the stars out beyond. The uneven heating of different layers of air causes a shimmering or twinkling of the stars and other heavenly bodies which makes the "seeing" poor. When there is a more equal heating of the air, higher magnifications can be used; but when the seeing is poor, a high magnification magnifies the distortion. So the amount of magnification which can be used depends upon the stillness of the atmosphere. Astronomers sometimes think with longing of the moon as the ideal place for an astronomical observatory, for there, where there is no air, the seeing would always be good.

In the reflecting telescope the rays of light fall upon a concave mirror (one that curves inward) and are reflected from it to another mirror, and the image is reflected again, this time to an eyepiece that mag-



Mount Wilson Observatory

Inside the Mount Wilson Observatory at Pasadena, California. This telescope has a reflector 100 inches in diameter.

TO HELP GATHER THE LIGHT OF STARS

R. Crane, Black Star

The tube of the giant Mount Palomar telescope. A concrete disc occupies the place where the mirror will go.

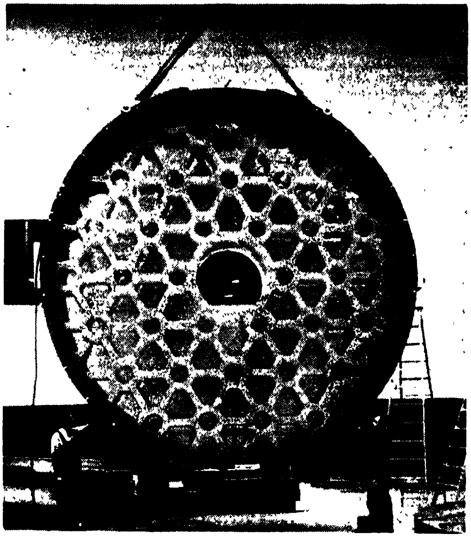
nifies the image. Various types of reflecting telescopes are in use, the most common being the Newtonian and the Cassegrainian forms. In the Newtonian form the eyepiece is at the side of the tube near the top of the telescope; and in the Cassegrainian type the eyepiece is at the lower end of the instrument.

For years the largest reflecting telescope was the Hooker Telescope at Mount Wilson Observatory in Pasadena, California. This has a mirror 100 inches in diameter. In 1947 a great 200-inch reflector was installed on Palomar Mountain, near San Diego, California. Astronomers have ambitious plans for using the 200-inch telescope. They hope to pierce the heavens far, far beyond the present known limits. Their plans will take years to fulfill.

COLLECTING LIGHT FROM DISTANT STARS IS THE MAIN WORK OF A TELESCOPE

The telescope is the basic instrument of the astronomer. It is used not only in actual observing, but in combination with other instruments. The main purpose of the telescope is not, as so many people erroneously believe, to magnify, though it does make things appear larger. The primary importance of this instrument is in collecting the light coming from distant objects, objects which would be too faint for the astronomer to study without optical aid. The telescope gathers and intensifies light so that the astronomer may study it by means of other instruments attached to the telescope. The "resolving power" of the telescope is extremely important, also. That is, objects which are so close that they appear to the eye as one are seen through the telescope to be separate. The telescope is, furthermore, a good pointer to indicate positions in the sky.

The telescope in team work with the photographic camera forms one of the astronomer's most important tools. The large telescopes are today used almost entirely in this way. The camera is attached to the seeing end of the telescope, or where the eyepiece would be. With the camera we can photograph objects that could not possibly be observed through the telescope with the human eye. A very faint star, for instance, does not give sufficient light for the human eye to see. And the longer the observer looks, the less well he sees, for the eye tends to tire. Put a camera in place of the eye, however, at the seeing end of the telescope, and what do we have? In the camera is a photographic plate covered with a sensitive emulsion which registers the presence of light, however faint. During a long time-exposure the camera's eye does not become tired, as a human eye would. The little point of light which represents the distant star continues to shine upon the emulsion, finally making an impression and recording its presence there. This point of light can then be studied by the astronomer at his leisure, after the plate is developed.



Courtesy, California Institute of Technology

The mirror for the Palomar Mountain telescope. It is 200 inches in diameter and is made of pyrex glass.

Telescopes are fitted with driving clocks which keep them turning at such speed that the same stars are always centered in the field of view. If the telescope did not turn to compensate for the rotation of the earth and the apparent westward motion of the stars, the images of the stars would appear as streaks of light instead of points.

Yes, the telescope and the camera together form a wonderful team for recording the presence and movement of the heavenly bodies. So much for collecting light. There are other extremely complicated instruments which are often used with the telescope and camera; and by means of them we are able to break up and analyze the light which comes from the stars. But first we must understand the principle on which these instruments work.

In 1666, nearly three hundred years ago, Sir Isaac Newton, one of the greatest physicists of all time, discovered a basic fact on which most of modern astronomy and astrophysics is founded. By passing a ray of sunlight through a prism, Sir Isaac found out that sunlight, or white light, is composed of all the colors of the rainbow. In other words, white light is not *plain* white light, but a mixture of light of different colors, or different wave-lengths.

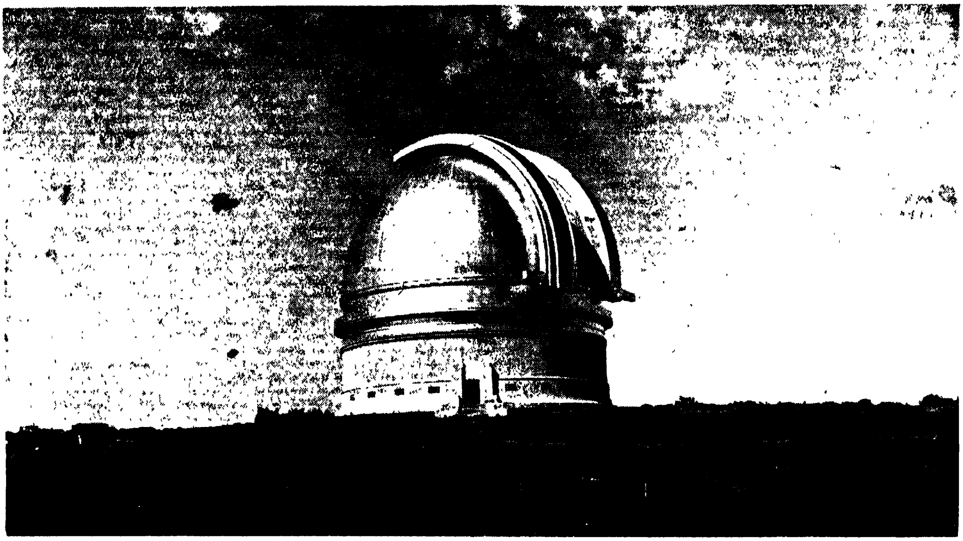
The band of colors which we observe when we break up white light is known as the spectrum. Red light, which has the longest wave-length of any light visible to the human eye, is at one end of the spectrum, and violet light, which has a wave-length about half as long as red, is at the other end. Sir Isaac Newton had discovered the key to one of the great secrets of the universe, but he did not learn how to use the key. An instrument such as a prism, that breaks light up into the spectrum, is now called a spectroscope.

There are many adaptations of the spectroscope, but if we understand the basic principle upon which it works, we shall see easily how it fits into the astronomer's work. The modern spectroscope is an instrument into which light enters through a very narrow slit, perhaps only a few thousandths of an inch in width. The light then passes through a lens known as a collimating lens which straightens out the diverging rays of light and makes them parallel. These parallel rays of light, from the sun, or from any other heavenly body, then pass through a prism which breaks up the light into the colors of which it is composed. This band of colors, the spectrum, is focused by an objective, and then studied through a small telescope attached to the other end of the spectroscope.

The spectrograph is this same type of instrument, but adapted for photographic work. Other adaptations, known as the spectrohelioscope and the spectroheliograph, are used in observing the sun under special conditions. Whenever you see *helio* in a word, you can be pretty sure the word has something to do with the sun.

But now that we have the band of colors spread out before us, what do we do with it? How do we use the key that Newton discovered? We use it to learn what the universe is made of.

Each chemical element in the universe possesses a distinct fingerprint, just as each individual person has fingerprints different form those of every other person in the world. By its distinct fingerprint an element can be recognized, whether it happens to exist in a laboratory on the earth, or in the most remote star. Each chemical element is recognized by its own distinct pattern of lines and colors in very definite places, always the same, in the spectrum. When we observe certain yellow lines in the spectrum, always in the same position in relation to the other lines, we recognize the fingerprint



Courtesy, California Institute of Technology

The observatory at Palomar Mountain, near San Diego, California. This is the home of the world's largest telescope.

Courtesy, California Institute of Technology

The Mount Palomar telescope will view all the heavens through this slit in the revolving dome of the observatory.

of the element sodium. When those lines occur, either in the spectrum of sunlight or in the spectrum of a distant star, we know that sodium is present in the body, in incandescent (glowing) gaseous form. And so with all the other elements.

In this way, by recognizing the spectral lines of any element, we are able to indentify the materials of which the stars are composed, or those which are present in the atmospheres of the planets. We have identified in the sun more than sixty of the ninety-odd elements known. The gas helium was discovered on the sun twenty-seven years before it was found on the earth—discovered, of course, through a peculiar pattern of lines which indicated in the solar spectrum the presence of an element not as yet known to man. Later, that same pattern of lines showed up when helium was discovered here. The name helium is symbolic of the discovery of the gas, for it is derived from Helios, the Greek name for the sun-god.

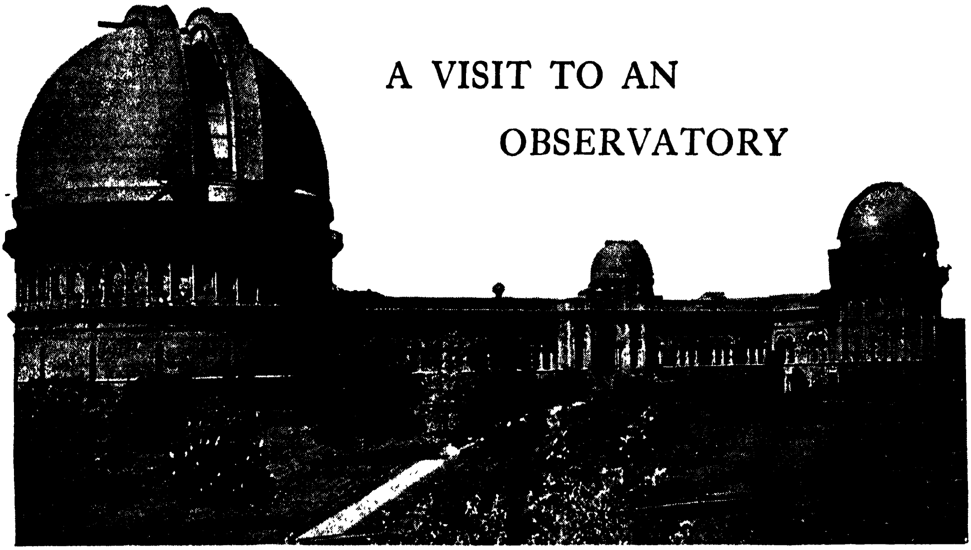
If the star, or other heavenly body, which is the source of the light being analyzed, is moving away from the earth, there is noticed in the spectrum a definite shift of the lines toward the red end. If the body is approaching, the lines shift toward the violet end. The astronomer can tell by examining the spectrum how fast the star is moving.

By other instruments, the interferometer and the bolometer, the astronomer can estimate the size and the temperature of stars. But in each case, the all-important thing is light, the messenger of the universe. Without light the instruments are useless. We have during this last century and a half (since about 1860) learned to interpret more correctly the messages which light is constantly sending to us from all parts of the universe. We have learned more, also, of the structure of the universe, and of our own comparative loneliness in space. We have learned, too, how small and unimportant our earthly home is.

One thing not even our most delicate instruments can tell us as yet. Are there other planets, other solar systems perhaps, with living beings? Possibly some day we shall have instruments that will tell us definitely "yes" or "no."

By Marian Lockwood.

A VISIT TO AN OBSERVATORY



Courtesy, Yerkes Observatory

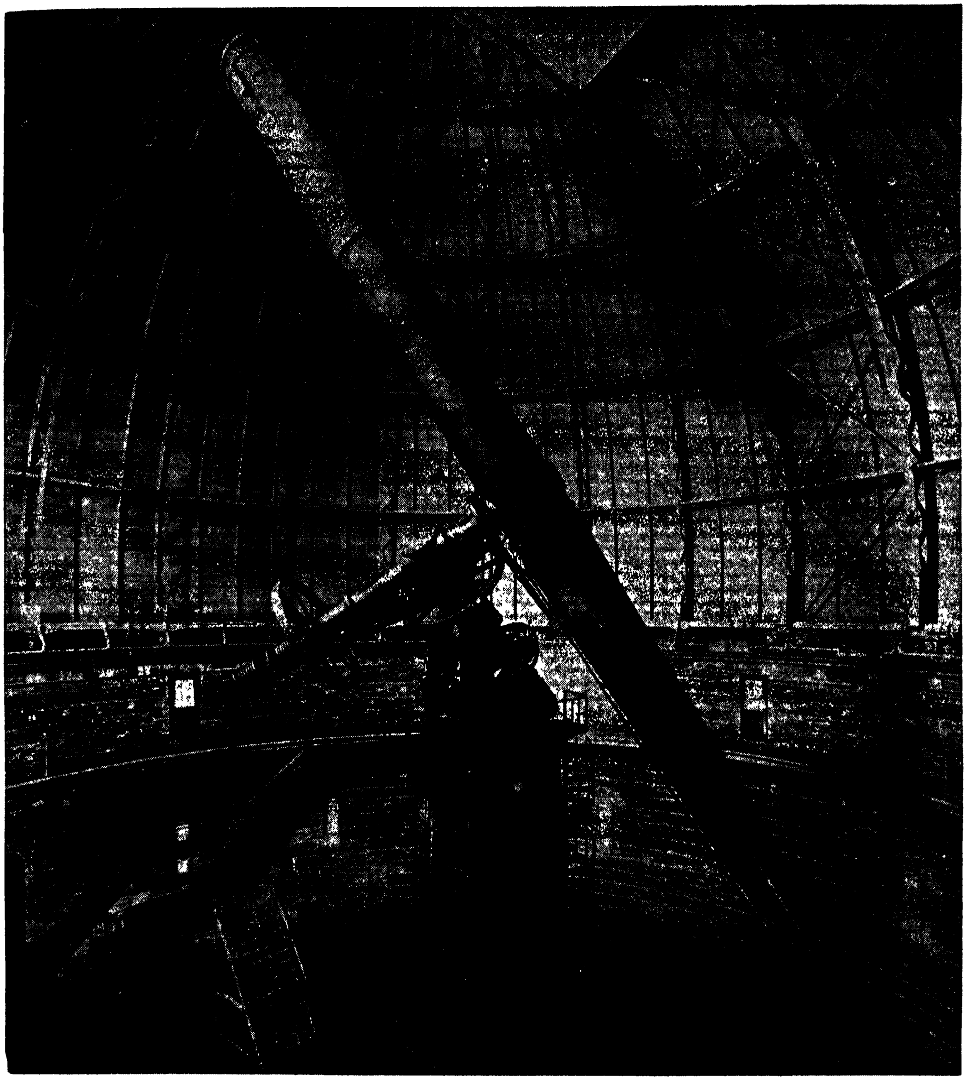
It is evening as we walk along a shadowy road up a slight incline to the crest of the hill toward the observatory. We are privileged guests, for usually the great building is closed in the evening to all but astronomers; the time of the great instruments is much too precious to spend in mere looking around the sky at planets, the moon or double stars and nebulae. The astronomers must use every clear moment for the unraveling of the secrets of the universe; smaller telescopes are good enough for the thrilled visitor taking his first look through a telescope.

We talk these things over as we approach the building. At one end of it is a small dome while at the other end we see a huge dome. We guess that the larger one covers a larger telescope; even as we walk along in the twilight, we see the huge dome slowly turning, until the great shutters, drawn aside to leave open the slit in the dome, are directed toward the half moon up high in the south.

For observing with the eye at the telescope, the desirable thing is magnifying power, so that the object being observed will be large enough for its details to be seen with ease. Now, a telescope that is comparatively small can magnify an object, such as one of the planets, so much that it will appear bigger than the moon does to the unaided eye. A larger telescope could magnify the planet much more, but it is seldom, if ever, used that way, for the more the object is magnified the more the disturbances of the air are magnified, too. You have looked up a hot road on a summer day to see everything in the distance wriggling and squirming because of the rising air currents. This effect is always present in our atmosphere, to a greater or less degree, and the telescope magnifies it. There is a degree of magnification beyond which it is unprofitable to go, for ordinary star-gazing. The largest telescope in the world can use no higher magnifying power than a much smaller telescope such as one might find in a small college observatory.

Of what value, then, is a huge telescope? Astronomers are always peering farther into space, studying fainter objects, and only a large telescope will make a very faint object bright enough for study. But the near-by bright objects do not need one of the large telescopes. Most observatories have telescopes of different sizes, and it is customary for the members of the interested public to look through one of the smaller ones, while the astronomers work with the larger ones.

Here we are, now, at the door; and we press the button at the side. It will be heeded tonight, for we are expected. The sound of a footstep inside on the mosaic floor of the long hall tells us that we shall soon see our friend, the astronomer. We greet each other and are ushered into a building which holds great fascination for us, for here learned men spend their lives



Courtesy, Yerkes Observatory

This is the great Yerkes Observatory telescope. Notice the elevating platform and the huge rolling dome above.

in adding, line by line, to our book of knowledge of the universe. We walk past doors of offices, in some of which men and women sit at measuring-microscopes, studying the photographs made with the large telescope we shall see in a moment. Others push the keys of computing machines, calculating numerical answers to some of the riddles of nature.

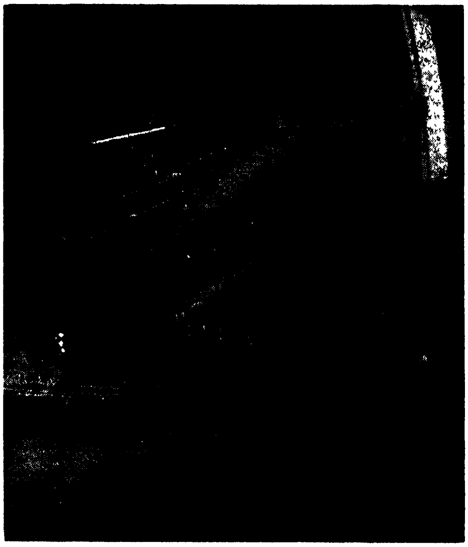
Up a short flight of steps we tread, in a faint light, and through a heavy iron door that is meant to keep out any fire, if ever such a thing should attack the rest of the building; the great telescope at least would be saved from the licking flames.

We step out upon a narrow balcony that encircles the whole room. A railing separates us from the actual floor of the room, and far out across the floor we see a huge pier or pillar—almost a tower, it seems—atop which there are wheels and axles. To these the enormous tube of the telescope is attached.

A gate in the balcony railing is swung open, and we step across a narrow gap to the floor, which seems to echo hollowly to our steps as we walk across it to the shadowy center where the telescope towers above us. By now it has grown almost dark and only the light of the moon, falling athwart the telescope and the floor, gives us light for our steps, although a dim, ruddy lamp on the pier serves as a guide.

There by that lamp at last we pause. Over us the monstrous shape of the giant instrument looms; it seems to be motionless, yet before us, inside the pier of the telescope, behind a window of glass, we see the whirling gears of a mechanism called the driving clock that is turning the telescope with infinite smoothness, slowly across the sky toward the west, to follow the apparent motion of the moon or any other object to which the instrument is pointed. For the earth is always rolling eastward beneath the stars, carrying us with it; as a result, the stars all appear to roll westward over us, and if our telescope were not moved constantly to follow this westward motion, the object under examination would drift away from the field of view of the telescope.

But now, after the astronomer has pressed a button on a small panel near the pier, we hear a rumbling sound, then feel a strange sensation of motion. We are rising! The whole great floor of the room is an elevator that carries all of us, and chairs, and observing ladders, up to a convenient level, so the lower end of the telescope is within easy reach! It is the largest elevator in the world; it is circular and it has a square hole in the middle of it. Through this hole the pier of the telescope protrudes; the instrument sits on a solid foundation buried in the earth, while the floor does not touch it. For if the floor touched the pier of the telescope, every step would cause the instrument to vibrate and the vibration, magnified many times by the telescope, would be easily visible to the observer using the instrument. No part of the telescope ever touches any part of the building.



Courtesy, Yerkes Observatory

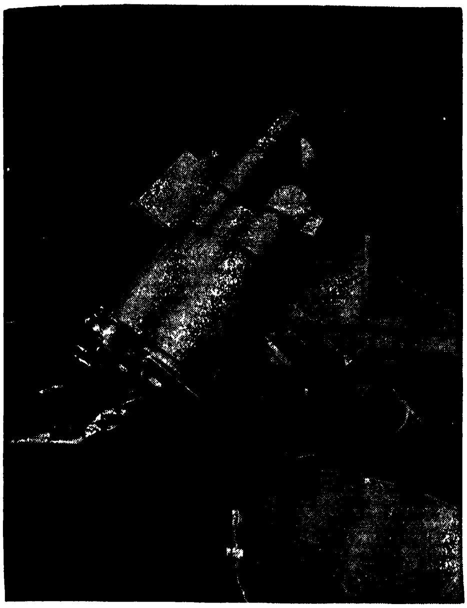
The end of the telescope nearest you is where you put your eye. The long tube is aimed out at the sky.

Courtesy, Mount Wilson Observatory

A picture of the heavens taken through a telescope.

Now we see that if we walk away from the center, toward the lower end of the telescope, we shall just be able to look through it, without standing on any steps. The rumbling sound ceases as the astronomer takes his finger from the button, and we all go out to look through the instrument. But now the edge of the slit that runs from the rim to the top of the dome is hiding some of the moon; the astronomer touches another button and a different sound is heard. For a moment we feel that we are turning, but then we realize that it is the dome which is turning a little, so the moon's light falls full on the great lens of the telescope. The astronomer steps to the lower end of the telescope, looks through the tiny lens called the eyepiece, makes a small adjustment, then invites us one by one to share the view.

When we first see the moon, our thoughts are strangely mixed. The scene is at once beautiful and terrible. There stand those ragged mountains, those yawning craters and barren deserts where nothing has changed for millions of years, where nothing grows, where the temperature by day is above the boiling point of water and by night is far below zero. Along the line that divides the dark from the bright portion of the moon, we see long



Courtesy, Yerkes Observatory

This type of telescope is used for making photographs. It has different lenses for different-size pictures.

shadows that help us discern the nature of the details. The astronomer tells us that only when the moon is in some partial phase do these features show clearly. He tells us there is no air and no water on the moon and that is why the scenery is so rugged and severe; there has been no erosion there, no wearing down of the high places or filling in of the low places by the action of wind and water. We all agree that, while the moon is a fascinating object to view through a great telescope, we are glad we live on earth.

When all have seen the moon, the astronomer suggests that Saturn might be next on the program. But the moon is high in the south, while Saturn is rather low in the west. The astronomer goes to the center of the floor, where he presses buttons on his control panel. The huge tube of the telescope changes direction, tilting so the eyepiece rises and swings to one side, as the astronomer, by reading numbers on his dials, points it exactly at the spot in the sky in which Saturn is to be found. Now the dome must be turned toward the west, and once more we hear the sound as the shell of many tons rolls smoothly along railroad rails, until we see the planet Saturn through the slit. But the floor is too low; the proper button must be pressed, so the floor will rise and carry us once more to the eye-end of the telescope.

When all is ready, once more we take our turns. The first to look exclaims, "Why it looks just like the pictures!" and so it does. Saturn is a lovely thing, poised delicately in the center of a set of rings that remind one of the brim of a hat. We see no motion, yet the planet is turning much faster than the earth. The millions upon millions of tiny particles which compose the rings are also revolving swiftly around their planet, ever in their proper places, so the appearance of the rings is preserved. To either side, outside the rings, small, starlike objects are seen; they are some of the "moons" of Saturn. The planet has nine moons in all, but seldom are more than five or six visible at one time. Some might be hidden in the shadow of the planet and some are exceedingly faint, to be seen well only on photographs.

Then we look at giant Jupiter, with its deep belted atmosphere of ammonia and marsh gas. Its strong markings enable us to see its rotation; the markings move across in one direction, those near one edge passing out of sight around the limb or edge of the disc, while new ones come into view at the other limb. Four of Jupiter's eleven moons are easily visible; they change their places as we watch them and one of them casts its shadow on the planet, to produce an eclipse of the sun. But there is no one there to see the eclipse, for on Jupiter it is very cold and the dense atmosphere, made up of noxious gases, is not suitable for anything that lives here on earth.

MERE HOURS SEEM UNIMPORTANT AS WE VIEW THE ETERNITY OF THE UNIVERSE

So the evening passes. As we linger we feel that we are leaving farther and farther behind all the worries of this world; we reach almost to infinity, through space and time. Some of the objects we see—faint star clusters and nebulae—are so distant that their light has been thousands of years on its way to us. The light we see from them tonight left there before the Pyramids were built, before man began to study science, before, even, man learned to raise inquiring eyes to the everlasting stars. We are a part of all eternity as we stand beneath the arching dome and use the great instrument that cunning hands devised.

Regretfully we take our leave; more silent than when we came, we walk the road down the hill, our minds filled with racing thoughts of creation and of worlds without end.

By Roy K. Marshall.

THE NEXT STORY OF THE EARTH IS ON PAGE 6631.

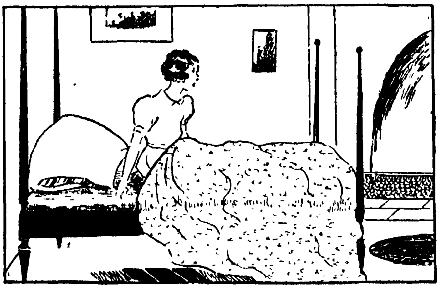
FRENCH—*The Noise in the Chimney*

First line, French; second line, English word; third line, as we say it in English.

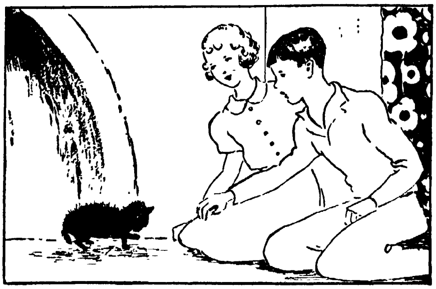
Il est huit heures. La chambre à coucher est noire. Nous sommes presque endormis.
It is eight hours. The room to to sleep is black. We are nearly asleep.
It is eight o'clock. The bedroom is dark. We are almost asleep.

Tout à coup il y a un bruit dans la cheminée. "Qui est là?" dis-je.
All at blow there is a noise in the chimney. "Who is there?" say I.
Suddenly there is a noise in the chimney. "Who is it?" I say.

On ne répond pas. La bonne entre; elle frotte une allumette et allume le gaz.
One(not)responds not. The nurse enters; she rubs a match and lights the gas.
There is no answer. Nurse comes in; she strikes a match and lights the gas.



Jeannette crie—Jenny screams.



Le petit chat—The kitten.

Quelque chose dégringole dans la cheminée et tombe sur le plancher.
Some thing tumbles down in the chimney and falls upon the floor.
Something slides down the chimney and falls on the floor.

Jeannette crie. La bonne dit: "Chut! Vous allez réveiller Bébé."
Jenny cries. The nurse says: "Hush! You go to awaken Baby."
Jenny screams. Nurse says: "Hush! You will wake Baby."

"C'est un petit chat," dis-je. "Il a peur. Puis-je lui donner du lait?"
"This is a little cat," say I. "He has fear. May I to him to give some milk?"
"It is a kitten," I say. "He is frightened. May I give him some milk?"

La bonne tire la sonnette et la servante apporte du lait dans une soucoupe.
The nurse pulls the bell and the servant brings some milk in a saucer.
Nurse rings the bell, and the maid brings some milk in a saucer.

Bébé se réveille et crie: "Joli minet! Puis-je l'avoir dans mon lit?"
Baby himself awakes and cries: "Pretty pussy! May I him to have in my bed?"
Baby wakes up and cries: "Pretty pussy! May I take him to bed?"

Mais la bonne dit: "Nous le mettrons dans cette corbeille près du feu."
But the nurse says: "We him will put in this basket near of the fire."
But Nurse says: "We will put him in this basket near the fire."

Le lendemain il était parti. Peut-être que les fées l'avaient emporté.
The next morning he was departed. Perhaps that the fairies him had carried away.
In the morning he was gone. Perhaps the fairies had taken him away.

THE NEXT FRENCH STORY IS ON PAGE 6840.

THE FIRST APPLE DUMPLING

ONCE there was a princess whose name was Dumpling. One day she was sitting under an apple tree.

PLOP!

Down fell an apple. It ALMOST hit Dumpling on the nose. It fell on the ground and rolled a little way and then lay quiet. It was a fine big apple, but it was not ripe. Not anywhere near ripe. So it lay and looked at Princess Dumpling.

"Oh dear!" said the princess, picking it up, "I hope you haven't hurt yourself."

"They dared me to do it," said the apple—"the other apples dared me. They said I was afraid to let go my stalk and jump. So I held my breath and counted one, two, three, and jumped. And now that I have done it, I'm sorry, because someone will want to eat me, and I am not nearly ripe enough! Oh my, no!"

"I will hide you," said the princess.

And she ran into the palace to look for a hiding-place. But whenever she opened a box or a cupboard the apple cried: "That won't do. Someone will find me there!"

The princess went all over the palace, upstairs and down, looking for a safe hiding-place. At last she came to the kitchen where the chief cook was rolling out dough with a golden rolling-pin to make a roly-poly pudding for the royal dinner.

One of the silver saucepans boiled over, and the chief cook stopped rolling the dough to take the saucepan off the stove. The minute his back was turned Princess Dumpling took some dough and wrapped the apple up in it.

"No one will think of looking for you there," she whispered.

Just then one of the assistant cooks opened an oven door

"I hope you haven't hurt yourself," said the princess.

and took a big tray of jelly tarts out of the oven.

So the princess popped the apple wrapped in dough into the oven and shut the oven door.

"Now you are hidden twice over!" she said, and she ran outdoors to play.

"Dear me, what is this?" asked the king at dinner, as he caught sight of a round brown thing on a dish.

"I don't know, Your Majesty," the royal waiter answered. "The chief cook said he found it in the oven. He thought Your Majesty would like to try it."

"Give me a knife and I'll see," said the king.

"My dear," said the queen, "be careful. It might go off and blow us all up!"

"Shucks!" said the king bravely. "Who's afraid?"

And he cut it in three parts and served it on golden plates, one piece for himself, one piece for the queen and one piece for Dumpling.

"Why," he said, "it looks like an apple!"

"It does look like an apple," said the queen. "But how could an apple grow inside a pudding?"

"It didn't grow there," said the princess. "I put it there to hide it. It was too green to be eaten. But now—."

"But now," said the queen, taking a little spoonful. . . .

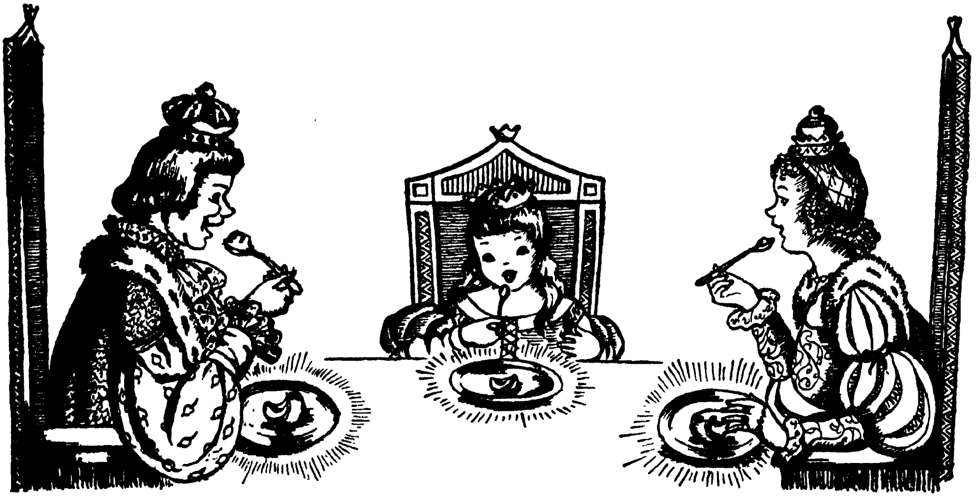
"But now," said the king, taking a big spoonful . . . . . .

"But now," said the princess, taking two spoonfuls . . . . . .

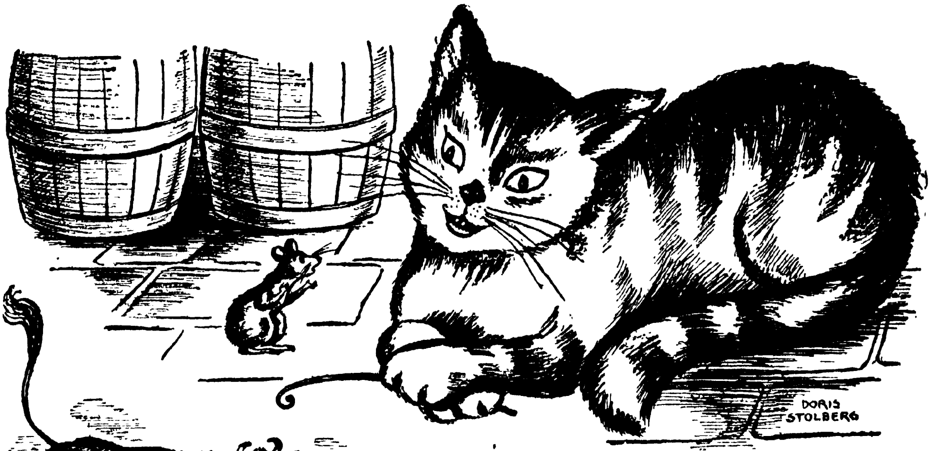
"Now," they all said, "now that it is baked, it is just right to be eaten!"

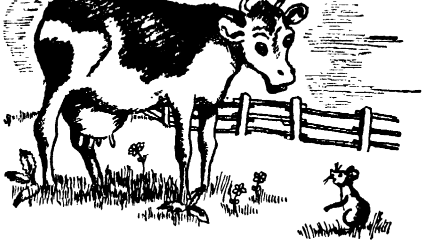
So the next day the king asked the princess to show the cook how to hide some more green apples.

And that is how apple dumplings were invented.



THE CAT AND THE MOUSE





The cat and the mouse
Played in the malt-house.

The cat bit the mouse's tail off.

"Pray, puss, give me my tail."

"No," said the cat, "I'll not give you your tail till you go to the cow and fetch me some milk."

First she leaped and then she ran,
Till she came to the cow, and
thus began:

"Pray, cow, give me milk, that I may give cat milk, that cat may give me my own tail again."

"No," said the cow, "I will give you no milk till you go to the farmer and fetch me some hay."

First she leaped and then she ran,
Till she came to the farmer, and
thus began:

"Pray, farmer, give me hay, that I may give cow hay, that cow may give me milk, that I may give cat milk, that cat may give me my own tail again."

"No," said the farmer, "I'll give you no hay till you go to the butcher and fetch me some meat."

First she leaped and then she ran,
Till she came to the butcher, and
thus began:

"Pray, butcher, give me meat, that I may give farmer meat, that farmer may give me hay, that I may give cow hay, that cow may give me milk, that I may give cat milk, that cat may give me my own tail again."

"No," said the butcher, "I'll give you no meat till you go to the baker and fetch me some bread."

First she leaped and then she ran,
Till she came to the baker, and
thus began:

"Pray, baker, give me bread, that I may give butcher bread, that butcher may give me meat, that I may give farmer meat, that farmer may give me hay, that I may give cow hay, that cow may give me milk, that I may give cat milk, that cat may give me my own tail again."

"Yes," said the baker, "I'll give you
some bread,
But if you eat my meal, I'll cut off
your head."

Then the baker gave mouse bread, and mouse gave butcher bread, and butcher gave mouse meat, and mouse gave farmer meat, and farmer gave mouse hay, and mouse gave cow hay, and cow gave mouse milk, and mouse gave cat milk, and cat gave mouse her own tail again.

JOHNNY CHUCK FINDS THE BEST THING IN THE WORLD*

By THORNTON W. BURGESS

OLD Mother West Wind had stopped to talk with the Slender Fir Tree.

"I've just come across the Green Meadows," said Old Mother West Wind, "and there I saw the Best Thing in the World."

Striped Chipmunk was sitting under the Slender Fir Tree.

Striped Chipmunk was sitting under the Slender Fir Tree and he couldn't help hearing what Old Mother West Wind said. "The Best Thing in the World—now what can that be?" thought Striped Chipmunk. "Why, it must be heaps and heaps of nuts and acorns! I'll go and find it."

So Striped Chipmunk started down the Lone Little Path through the wood as fast as he could run. Pretty soon he met Peter Rabbit.

"Where are you going in such a hurry, Striped Chipmunk?" asked Peter Rabbit.

"Down in the Green Meadows to find the Best Thing in the World," replied Striped Chipmunk, and ran faster.

"The Best Thing in the World," said Peter Rabbit, "why, that must be a great pile of carrots and cabbage! I think I'll go and find it."

So Peter Rabbit started down the Lone Little Path through the wood as fast as he could go after Striped Chipmunk.

As they passed the great hollow tree Bobby Coon put his head out. "Where are you going in such a hurry?" asked Bobby Coon.

"Down in the Green Meadows to find the Best Thing in the World!" shouted Striped Chipmunk and Peter Rabbit, and both began to run faster.

"The Best Thing in the World," said Bobby Coon to himself, "why, that must be a whole field of sweet milky corn! I think I'll go and find it."

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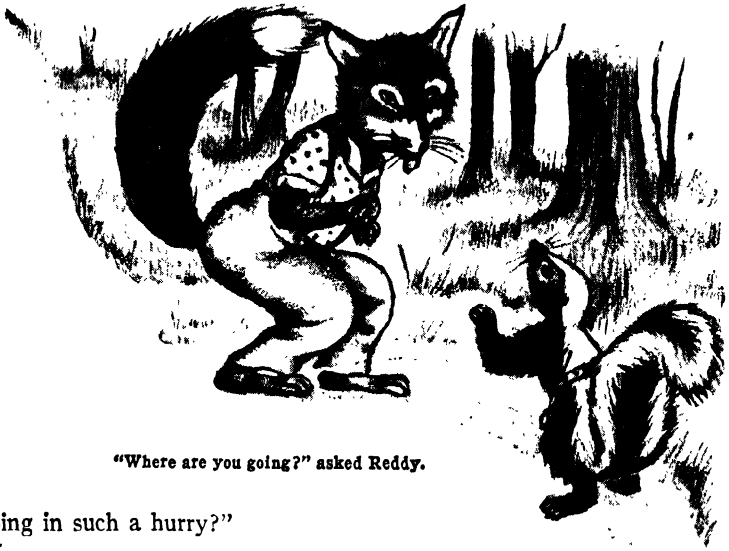
*From "Old Mother West Wind" by Thornton Burgess. Reprinted by permission of Little, Brown and Company.

So Bobby Coon climbed down out of the great hollow tree and started down the Lone Little Path through the wood as fast as he could go after Striped Chipmunk and Peter Rabbit, for there is nothing that Bobby Coon likes to eat so well as sweet milky corn.

At the edge of the wood they met Jimmy Skunk.


"Where are you going?" asked Reddy.

"Where are you going in such a hurry?" asked Jimmy Skunk.

"Down in the Green Meadows to find the Best Thing in the World!" shouted Striped Chipmunk and Peter Rabbit and Bobby Coon. Then they all tried to run faster.

"The Best Thing in the World," said Jimmy Skunk. "Why, that must be packs and packs of beetles!" and for once in his life Jimmy Skunk began to hurry down the Lone Little Path after Striped Chipmunk and Peter Rabbit and Bobby Coon.

They were all running so fast that they didn't see Reddy Fox until he jumped out of the long grass and asked:

"Where are you going in such a hurry?"

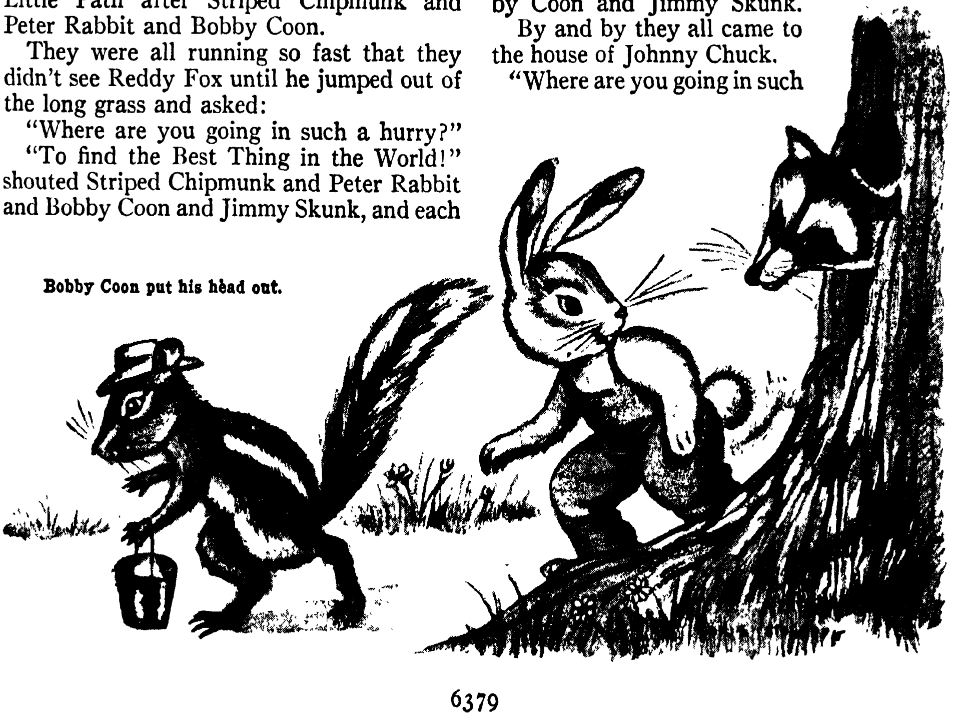
"To find the Best Thing in the World!" shouted Striped Chipmunk and Peter Rabbit and Bobby Coon and Jimmy Skunk, and each did his best to run faster.

"The Best Thing in the World," said Reddy Fox to himself. "Why, that must be a whole pen full of tender young chickens, and I must have them."

So away went Reddy Fox as fast as he could run down the Lone Little Path after Striped Chipmunk, Peter Rabbit, Bobby Coon and Jimmy Skunk.

By and by they all came to the house of Johnny Chuck.

"Where are you going in such


Bobby Coon put his head out.

a hurry?" asked Johnny Chuck.

"To find the Best Thing in the World," shouted Striped Chipmunk and Peter Rabbit and Bobby Coon and Jimmy Skunk and Reddy Fox.

"The Best Thing in the World," said Johnny Chuck. "Why I don't know of anything better than my own little home and the warm sunshine and the beautiful blue sky."

So Johnny Chuck stayed at home and played all day among the flowers with the Merry Little Breezes of Old Mother West Wind and was as happy as could be.

But all day long Striped Chipmunk and Peter Rabbit and Bobby Coon and Jimmy Skunk and Reddy Fox ran this way and ran that way over the Green Meadows trying to find the Best Thing in the World. The sun was very, very warm and they ran so far and they ran so fast that they were very, very hot and tired, and still they hadn't found the Best Thing in the World.

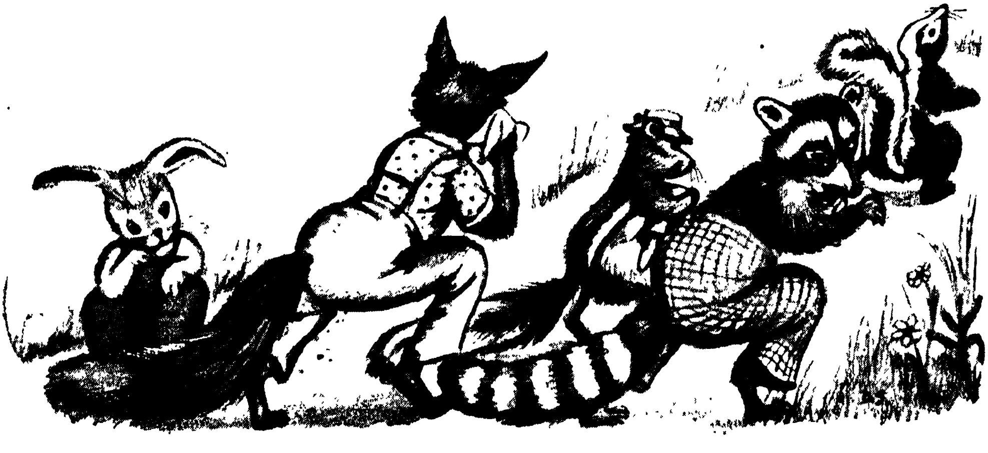
When the long day was over they started up the Lone Little Path past Johnny Chuck's house to their own homes. They didn't hurry now for they were so very, very tired! And they were cross—oh so cross! Striped Chipmunk hadn't found a single nut. Peter Rabbit hadn't found so much as the leaf of a cabbage. Bobby Coon hadn't found the tiniest bit of sweet milky corn. Jimmy Skunk hadn't seen a single beetle. Reddy Fox hadn't heard so much as the peep of a chicken. And all were as hungry as hungry could be.

Half way up the Lone Little Path they met Old Mother West Wind going to her home behind the hill. "Did you find the Best Thing in the World?" asked Old Mother West Wind.

"No!" shouted Striped Chipmunk and Peter Rabbit and Bobby Coon and Jimmy Skunk and Reddy Fox all together.

"Johnny Chuck has it," said Old Mother West Wind. "It is being happy with the things you have and not wanting things which someone else has. And it is called Content-ment."

THE NEXT READ ALOUD STORIES ARE ON PAGE 6473.

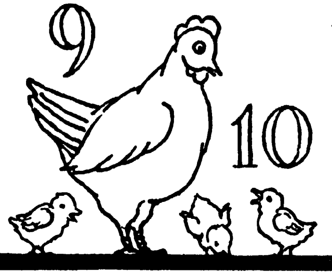


ONE, TWO
Buckle my shoe

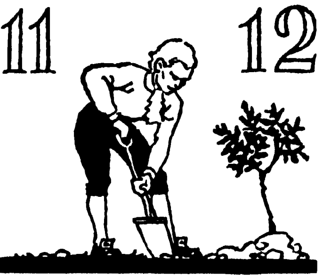
THREE, FOUR
Knock at the door

FIVE, SIX
Pick up sticks

SEVEN, EIGHT
Lay them straight

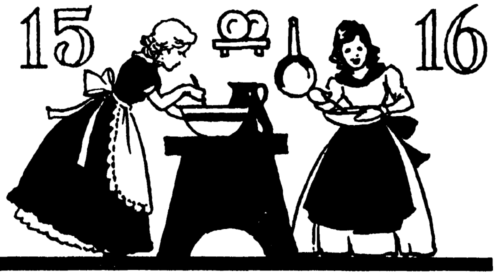


NINE, TEN
A good fat hen



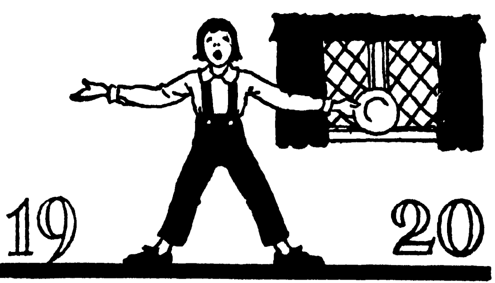
ELEVEN, TWELVE
Dig and delve

THIRTEEN, FOURTEEN
Maids a'courting



FIFTEEN, SIXTEEN
Maids in the kitchen

SEVENTEEN, EIGHTEEN
Maids a'waiting



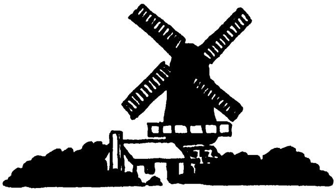
NINETEEN, TWENTY
My plate's empty.

PLEASE, MOTHER, GIVE ME SOME DINNER!

THERE was a little man,
And he had a little gun,
And his bullets were made of
lead,
lead,
lead.
He went to a brook,
And fired at a duck,
And shot him right through the
head,
head,
head.
He carried it home
To his old wife Joan,
And bid her a fire for to
make,
make,
make.
To roast the little duck
He had shot in the brook,
And he'd go fetch the
drake,
drake,
drake.

RAIN, rain, go away;
Come again another day;
Little Johnny wants to play.

HECTOR PROTECTOR
was dressed all in green.
HECTOR PROTECTOR
was sent to the Queen.
The Queen did not like him,
No more did the King;
So HECTOR PROTECTOR
was sent back again.



THERE was a jolly miller
Lived on the River Dee;
He worked and sang
from morn till night
No lark so blithe as he;
And this the burden of his song
Forever used to be—
I jump MEJERRIME JEE!
I care for nobody—no! not I
Since nobody cares for me.

CURLY LOCKS

Curly locks! curly locks!
wilt thou be mine?
Thou shalt not wash dishes,
nor yet feed the swine;
But sit on a cushion,
and sew a fine seam,
And feed upon strawberries,
sugar and cream.

* * *

CHARLEY barley wheat and rye
Kissed the girls and made them cry;
When the girls came out to play,
Charley barley ran away.

POLLY FLINDERS

Little Polly Flinders,
Sat among the cinders,
Warming her pretty little toes;
Her mother came and caught her,
And whipped her little daughter
For spoiling
her nice
new
clothes.

A TISKET, A TASKET

A tisket, a tasket,
a green and yellow basket,
I wrote a letter to my love,
but on the way I lost it,
lost it, lost it.

(Hurry up and
drop it!)

TWINKLE, twinkle, little star;
How I wonder what you are!
Up above the world, so high,
Like a diamond in the sky.

When the blazing sun is gone,
When he nothing shines upon,
Then you show your little light,
Twinkle, twinkle, all the night.

Then the traveler in the dark,
Thanks you for your tiny spark;
He could not tell which way to go
If you did not twinkle so.

In the dark blue sky you keep,
And often through my curtains peep.
For you never shut your eye
Till the sun is in the sky.

As your bright and tiny spark
Lights the traveler in the dark,
Though I know not what you are,
Twinkle, twinkle, little star.

* * *

WEE Willie Winkie runs through the town,
Upstairs and downstairs
In his nightgown,
Tirling at the window, crying at the lock,
"Are the weans in their bed,
for it's now ten o'clock?"

Socrates, second from left, leading a discussion among a group of his pupils.

The STORY *of* SOCRATES

THE ancient Greek city of Athens developed a wonderful civilization in the course of the fifth century B.C., while the great statesman Pericles was in power. In this Periclean Age, as it was called, Athens boasted of renowned thinkers, dramatists, historians, architects and sculptors. We tell you about the period in The Story of Greece and in other articles of THE BOOK OF KNOWLEDGE.

Perhaps the chief glory of Athens in the Periclean Age was a citizen named Socrates. His appearance did not impress men at first. He was short and thickset; he had a flat nose, thick lips, bulging eyes and a bald head; he waddled awkwardly as he walked. He was not a famous statesman, nor an eloquent writer nor a talented artist; he was merely a humble lover of truth. Yet he was one of the wisest men who ever lived; and few men have been more beloved.

Socrates was born at Athens about 470 B.C. He is said to have been a sculptor for a time, as his father had been before him; but this is not certain. We do know that he fought in the Athenian army as a heavy-armed foot-soldier and that he won a reputation for bravery. But throughout his life his chief occupation was the pursuit of wisdom and the diligent practice of virtue.

As a young man he studied the works of the Greek philosophers. Each of them claimed to know all about the creation of the world and the natural laws governing it; but, somehow or other, no two were in agreement. Socrates came to believe that it was a waste of time to try to solve such mysteries. "Would it not be better," he asked, "to concern ourselves with making our lives better and more satisfying?" And so he studied the problems of man's character and conduct rather than the laws of nature. As one ancient philosopher put it, "Socrates brought philosophy down from heaven to earth."

In his search for wisdom Socrates did not shut himself up in his chamber and try to find what he sought in books. Instead, he spent his time in the public streets, in the gymnasiums and in the market-place, and he talked with all kinds of men. He drew from them by a series of skillful questions just what each of them knew or did not know. By this method of question and answer, he said, he brought forth from men's minds the truths that were lying there unknown to them. We give the name Socratic method to this kind of teaching.

What were the ideas of Socrates? Among other things, he believed that the chief aim of man should be to learn the ways of goodness: to live temperately, to be just to one's fellow-men, to be devoted to one's fatherland. Only in this way can one win real happiness. And it is not enough to be good oneself; one should try to spread the knowledge of goodness. Socrates believed that there are no truly wicked people. He thought that those whom men call wicked are simply ignorant, and that they can be taught to live useful and happy lives.

Socrates gathered around him a circle of admiring followers. They were deeply impressed by his skill in reasoning, by his remarkable self-control, by his belief that a divine voice within him checked him from acting wrongly. Among the most famous of these disciples were Plato, Xenophon and Alcibiades. (See Index, under these names.) We know of Socrates chiefly through the writings of Plato and Xenophon.

Some good people think that it is sinful to be gay. Socrates did not believe that a good man must always frown on the pleasant things of life. He can appreciate the delights of good food and drink and, above all, good company. Perhaps one reason why Socrates delighted in the company of his friends was that he had little comfort at home. His wife, Xanthippe, was a quarrelsome woman, who gave him no peace. Socrates once said humorously that he put up with her as a sort of exercise in self-control.

One would have thought that a man like Socrates would have no enemies. Yet he deeply offended some of his fellow-citizens. He was himself a devout man, but he did not believe in the old myths which represented some of the gods as being dishonest or bloodthirsty. People who did not understand his ideas were convinced that Socrates was trying to undermine the good old beliefs and customs of the past. They were particularly angry because he persuaded many young people to accept his own ideas.

Sculpture, Harry Bates; photo, F. Hollyer

Socrates, earnestly discoursing on justice, with a young onlooker.

In the year 399 B.C. Socrates was accused of doing harm to the state by attacking religious beliefs and by leading the young astray. He was brought to trial before a jury made up of some five hundred Athenian citizens, and he was found guilty. According to custom, Socrates was permitted to tell the judges what punishment he deserved. He angered them by saying that his "punishment" should be to be fed at public expense, as a benefactor of mankind. It is true that he later accepted the advice of his friends, and suggested a moderate fine as his punishment. But the damage had been done. The indignant judges condemmed him to die by drinking hemlock, the poison from the herb.

The execution was held up for thirty days, until the return of a ship that had been sent on a sacred mission to the island of Delos. During this time he was permitted to receive his friends in his cell. He conversed with them, as he had done in happier days, about goodness and justice and temperance. The disciples of Socrates could not bear the thought that their beloved master was to die so soon. They offered to help him to escape. But he refused. As a good citizen, he said, he had always obeyed the laws. It was his duty to obey them now even though they were applied by bad men.

At last the fatal day came; Socrates was to die at twilight. Early in the morning his wife and friends met in his cell to spend the last hours with him. Xanthippe showed her grief by loud cries; and Socrates had her removed from the cell so that he might spend his last hours in peace. He then talked calmly with his friends. He bade them always to remember his sayings; he urged them not to mourn for him, for he was soon to enter upon a new and better life.

When it was time at last, he took the cup of hemlock and drank it slowly. Then, walking up and down his cell, he tried to comfort his weeping friends. At last the poison took effect. He lay down upon his couch, reminded his friends of a sacrifice that they owed to one of the gods, covered himself with his cloak and breathed his last. "Thus died," says Plato, "the man who in death was the noblest of all, in life the wisest and the most just."

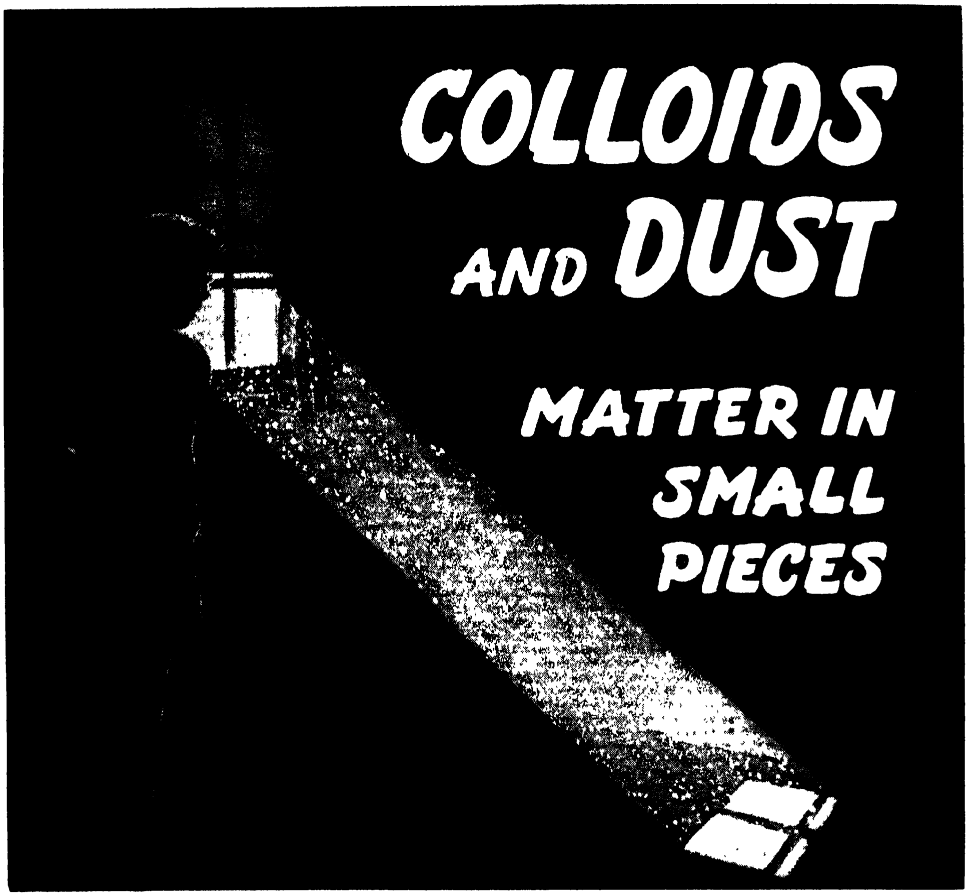
THE NEXT STORY OF MEN AND WOMEN IS ON PAGE 6508.

HOW TO PRONOUNCE THE GREEK NAMES USED IN THIS ARTICLE

Alcibiades (al-see-by′-ah-deez)
Athenian (a-thee′-nih-an)
Athens (ath′-enz)
Periclean (per-ih-clee′-an)
Pericles (per′-ih-cleez)
Plato (play′-toh)
Socrates (sok′-rah-teez)
Socratic (soh-crat′-ic)
Xanthippe (zan-tip′ee)
Xenophon (zen′-oh-fon)

Courtesy of the Metropolitan Museum of Art

David, a French artist of the nineteenth century, here portrays the death of Socrates. The Greek philosopher, convicted of corrupting the youth of Athens, ended his life by drinking a cup of poison hemlock. That was a method of execution used in Athens in ancient times. While his friends and companions wept and bemoaned his untimely end, the wise philosopher accepted his fate with great calm, instructing his followers in the ways of wisdom and virtue until the very moment when he lost consciousness.



COLLOIDS AND DUST

MATTER IN SMALL PIECES

WHEN you sweep a dusty room, you can see little gray clouds flying up from your broom. If you stand in a dark corner, and look at a sunbeam cutting a path through the room, you will see something rather wonderful. Bits of gold and other colors seem to be flashing and dancing in the sunbeam. These are dust particles, lighted up by the sun's rays. They will settle in time.

Much tinier dust-like particles of matter are to be found throughout our world, and even in the spaces between the stars. The particles range in size from those which our unaided eyes can see to those that can be detected only with such instruments as the ultramicroscope and the electron microscope. A few experiments will reveal their comparative size.

Put some fairly large grains of sand into a glass of water and stir them. Hold the mixture up to the light. You will see that it is not clear, that it is not transparent and that it is not uniform. Finally, the sand settles to the bottom. Now stir the mixture again, and strain it through filter paper. (Filter paper is a rather coarse kind of paper that has little pores, or holes, in it, one three-thousandths of a millimeter in diameter. One inch contains 25.4 millimeters.) The large sand grains will not go through the paper—the openings are far too small.

Repeat the experiment with a few grains of sugar. As you stir, the sugar seems to disappear. The mixture is clear, transparent and uniform. The sugar does not settle. If the mixture is strained through filter paper, no grains are held back. The entire liquid goes through even these tiny pores. The sugar in the water has been divided up into very, very small particles that can not be seen by any instrument. Actually the sugar grains have been divided into molecules. We say the sugar has dissolved.

Now repeat the experiment with a pinch of laundry starch. This disappears slowly, and a clear mixture is obtained; this, too, will pass through filter paper. It looks as though the starch has been divided into molecules like the sugar.

But let us try another test with the sugar and the starch. Take two bags made of parchment paper or of collodion, and pour starch water into one and sugar water into the other. Hang the bags in a jar of clear, distilled water. You will soon find that some of the sugar has seeped into the water, but no starch has gone through. The pores in the parchment are too small for the starch particles, but are large enough for the sugar molecules to go through. The particles that will not go through vary in size from one ten-thousandth of a millimeter to one one-millionth of a millimeter in diameter. We call them colloidal particles. The substances which are divided up into these colloidal particles are said to exist as colloids. A mixture of the colloidal particles and the medium through which they are scattered is called a colloidal dispersion. (A mixture of molecules is called a solution.) The method of separating a mixture of colloids and dissolved substances by the use of a membrane such as collodion is called dialysis, from the Greek word meaning to tear apart.

If you pass a beam of light through sugar water, you can hardly see the rays, even though the room be completely darkened. Pass the same beam of light through a colloidal solution like the starch water (held against a dark background) and the rays show up very clearly. The colloidal particles are large enough to scatter the light and make the beam visible. This phenomenon is called the Tyndall effect.

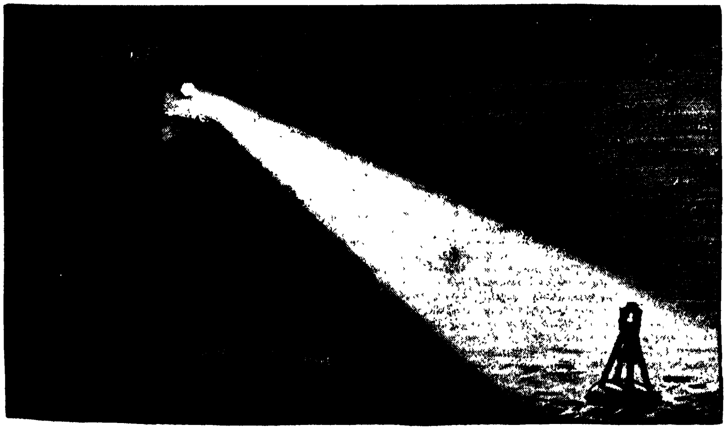
A still more striking result is produced when a microscope is focused directly upon certain colloidal dispersions, like colloidal gold. Use a dark background, and pass a beam of light from an arc lamp through the colloid: you can see specks of light dancing about in jiggling, zigzag fashion.

The colloidal particles are being knocked about and kept in motion by the movement of the water molecules surrounding them. This irregular motion, due to bombardment by surrounding molecules, is called Brownian movement, after Robert Brown, a Scottish botanist who first observed such motions with pollen grains. (Pollen grains are much larger than colloidal particles.) The combination of a beam of light and a microscope, with a dark background, is called the ultramicroscope.

An imitation ultramicroscope effect can be observed when rays of sunlight come into a dark room, as described in the first paragraph. When a searchlight illuminates a foggy or smoky atmosphere you get the same result. Shimmering, dancing dust specks are seen. These dust particles are much larger than colloidal particles, to be sure, but they are small enough to act very much like them.

One of the most important characteristics of colloids is the fact that they are scattered and so finely divided. This makes available a very great surface of the colloidal material, and, as you have learned, the speed of any chemical reaction depends, in part, on the amount of surface available.

Suppose we try to show just how great a surface area may become by being broken up into colloidal particles. Imagine a little toy



When a searchlight shines through the fog it is possible to see many shimmering dust particles dancing in the beam. Dust particles are larger than colloidal particles but they act in very much the same manner.

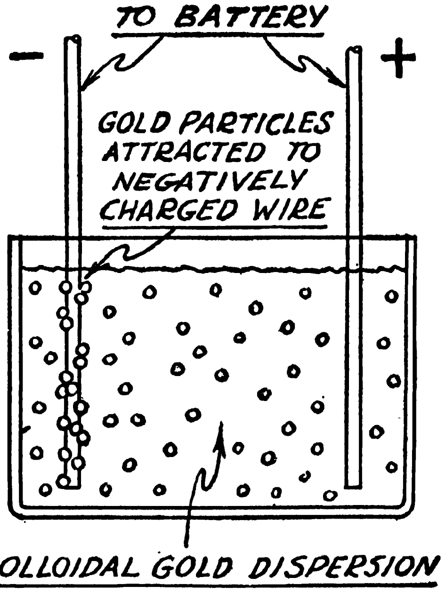
building block of wood that is one centimeter long on each edge. It is, therefore, a cube. The flat surface of any one face will be one centimeter long by one centimeter wide. The area, or surface, of each face is, then, one square centimeter. Since the block has six faces, its total surface is six square centimeters. If these six square centimeters were laid out over a page of your BOOK OF KNOWLEDGE, they would cover the depth of two lines, and a width of less than a column.

If you cut the block in half, each piece will have half the amount of wood that the big block had. No wood is lost, and if you stick the two pieces back together again, you will have the same quantity of material. In other words, the volume of wood is still the same. However, the flat surface, or area, of the two pieces will be greater than if the block had not been cut. There will be more faces and if you add up the individual areas, you will find that the total area has increased from six square centimeters to eight square centimeters.

If you kept on cutting, the total surface increases more and more. When the same single block is finally broken up into tiny pieces the size of colloidal particles, the total surface will be 60,000,000 square centimeters! The volume will be the same, but the surface will now cover 200,000 pages of this book, or more than all the pages in 250 books!

Finely divided particles may be either solid, liquid or gas. The substances in which they are dispersed may also be solid, liquid or gas. The starch water we have mentioned is a solid in a liquid. A colloidal fluid like this is called a sol. Glues are also sols of solids in liquids. Mayonnaise is an emulsion of the liquids oil and vinegar which is kept from separating out, or as we say, made stable, by means of egg yolk. Homogenized milk contains butterfat dispersed in water (to be more exact, a mixture of water, casein, lactose and salts.) These are examples of dispersions of liquids in liquids. Whipped cream is an example of a gas dispersed in a liquid. Smoke clouds and fine, dispersed dust particles are solids suspended in air—a gas.

Finely divided particles may be either solid, gas or liquid. Whipped cream is a gas dispersed in a liquid.


TO BATTERY
-
+
GOLD PARTICLES ATTRACTED TO NEGATIVELY CHARGED WIRE
COLLOIDAL GOLD DISPERSION

Colloids may be electrically charged. Thus, above, the positive gold particles move toward the negative wire.

Another property of colloids that is interesting is the fact that they are very often electrically charged. You know that a negatively charged body has more electrons than protons, and that a positively charged body has less electrons than protons. When equally and oppositely charged bodies come together, the plus charge equalizes the minus charge, and a neutral, or uncharged, body results.

If two wires from a battery are placed in a colloidal gold dispersion, you can see pieces of the metal deposited on one wire. Gold colloid has a positive charge. The wire upon which it collects receives electrons from the battery, and is negatively charged. Thus, the positive colloid is attracted to the negative wire and neutralized.

It seems that one of the reasons why colloidal particles do not join together and settle to the bottom of a solution is the fact that they are electrically charged. Since the particles are charged in the same way, they repel each other and do not settle together.

In the curdling of milk we see how this principle of electric charge comes into action. The casein (cheese) in milk is in colloidal dispersion. When the sugar in milk ferments, lactic acid is produced. The hydrogen ions in the acids are positive, and they are attracted to the negative colloidal particles, which are now neutralized. Since they no longer repel each other, the particles then bunch together in little lumps. We say that the colloidal substance has coagulated.

When a liquid colloid mixture becomes rather solid we call it a gel. The most familiar example is gelatin, a common dessert on your dinner table.

SOME IMPORTANT COLLOIDAL SUBSTANCES WITH WHICH WE ARE FAMILIAR

Colloids play an important part in our life. Most of the organic material in plant cells and in animal cells is collodial. Colloids make up hides, from which leather is manufactured. They make up much of our food, our fuel and the materials from which our homes are made.

Dust is something to which we may not give much thought, yet it causes many important things to happen, some of which are familiar to us. Let us mention a few of the interesting facts about dust. In one cubic centimeter of city air (imagine a little box whose edges are somewhat less than one-half inch long) there are on an average about 160,000 dust particles. In the country the average number of particles in still weather drops to 20,000 per cubic centimeter. In a dense smoke the number of particles may be as high as 5,000,000!

As we go up higher into the sky the number of dust particles in the air gets less and less. Fine dust does exist, though, even at remote distances from the earth. It is caused by collision of heavenly bodies and the breaking up of meteorites and comets. We call it cosmic dust.

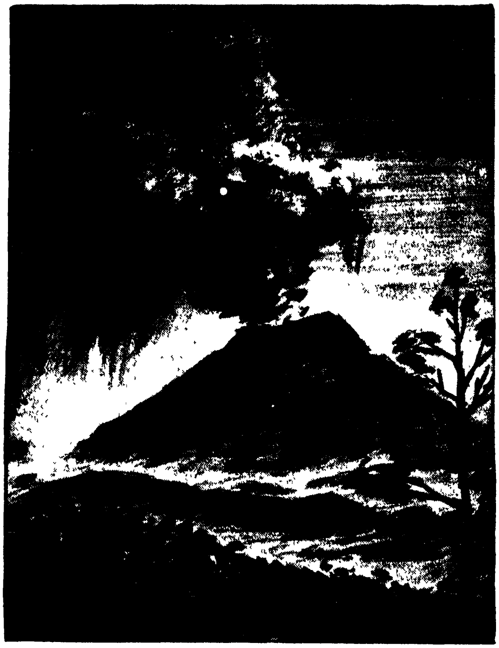
HOW PARTICLES OF DUST MAKE BEAUTIFUL COLORS IN THE SKY

The presence of dust particles is to a large extent the cause of colorful sunsets and sunrises. It also makes the sky look blue.

How does it do that? Well, you know that when a beam of light passes through a prism and shines on a wall, it breaks up into a band of colors consisting of violet, indigo, blue, yellow, green, orange and red—the spectrum. (You can read more about this in Color And What Makes It.) Up in the sky, when the sunlight hits small particles of gas (air) and dust, the short light-waves near the violet end of the spectrum are scattered in many directions, while the longer ones at the red end go through. The light that reaches us directly from the sun has lost some of its blue waves. These blue waves we see scattered throughout the sky. The direct rays of the sun itself (when deprived of only some of the blue waves, and very little of the longer waves) is yellow-white. In the morning and at evening, when the sun is at the horizon, its slanting beams come to us across many layers of the atmosphere. Practically all the blue waves are scattered. Much of the longer wave-length light may also be scattered. At times so much scattering takes place that the direct rays of the sun that come to us are almost all red, and we see a fiery red sun which paints the clouds in beautiful colors.

Dust particles also serve as centers around which molecules of water vapor condense to form fog, clouds and rain. In a dustless atmosphere there would be no clouds and no rain, as we know them. The condensation of vapor would occur on surfaces—clothing and buildings.

You have all noticed how brilliantly the sun seems to shine immediately after a rain. This is because the water has temporarily cleansed the dust from the atmosphere, and



The great Krakatoa volcano explosion, near Java, scattered dust particles for over a thousand miles, and caused strange color effects in the sky throughout the world. This happened in the year 1883.

the sun's light comes through with less interference.

Oftentimes the wind whips and raises dust into the air, and carries great quantities of it through the sky. On February 21 and February 22, 1903, windstorms carried ten million tons of dust from African deserts in the course of two days, and clouded many European countries as far north as the British Isles.

On Sunday, November 12, 1933, howling winds blew over the regions extending from Lake Superior to the lower Missouri Valley in the United States. Such dust was raised from the parched and dry soil that midday was turned into night.

One of the greatest volcanic eruptions in history took place on the island of Krakatoa, near Java, in 1883. The explosion was heard in Australia, 2,000 miles away, and the dust particles that filled the air took two years to settle. Extraordinary color effects were seen by people all over the world.

Dust contains particles of many different substances. It may be made up of organic materials such as hay and pollen grains, particles of clay and sand from rocks that are breaking down, or salt from the oceans. It may be what we know as smoke, which is a cloud of tiny particles resulting from imperfect burning of fuels in furnaces.

Many of the effects of dust are harmful. Pollen grains may produce hay fever, and bacteria attached to dust may cause many diseases. Silica dust is especially dangerous if inhaled in sufficient amounts. It damages the lungs. The dusts of asbestos, of coal and of some metals are harmful in varying degrees, depending upon their quantities. It is strange to note that indoor dust is much more dangerous than outdoor dust. Germs are usually not present in atmospheric dust to the same extent that they are in household particles.

Sometimes you hear of the most unexpected fires and explosions. You know how a chemical reaction can be speeded by an increase in the surface area of the materials involved. Dust particles represent just such a large surface area, and are often the cause of combustion in flour mills, coal mines and even in sugar mills.

Industry has made efforts to reduce these dangers by doing away with certain dusts and by preventing the dispersion of others. Air conditioning has helped to keep the atmosphere clean. Many industries have even found that recovery of dusts is quite profitable. Gold dust, for instance, is carefully swept up in gold-working plants.

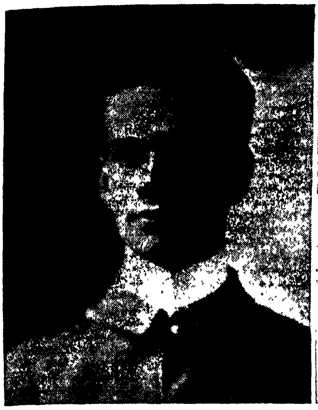
Dust is a special problem to large cities. Smoke settles on furnishings, and discolors them greatly; buildings are blackened and sometimes eaten away. Trees, plants and even men are starved for sunlight in some places where smoke shuts off as much as 40 per cent of the healthful rays. In certain cities only a few smoke-resistant trees, such as the ailanthus, can survive this serious deficiency.

The loss of sunlight causes disease in the breathing passage, and bone diseases, such as rickets. Much of this smoke nuisance comes from incomplete burning of fuels. By the proper use of the correct furnaces, more heat can be obtained from fuel, and the smoke can be reduced. Factory dust and smoke can be largely done away with by electrical methods such as the Cottrell process or by the Precipitron. In the Precipitron method, air is passed through a highly charged electrical field where each dust particle in it becomes positively charged. The charged particles then enter a chamber that contains plates, some of them negatively charged. The positively charged dust settles upon the negatively charged plates. In this manner the very finest dust can be removed.

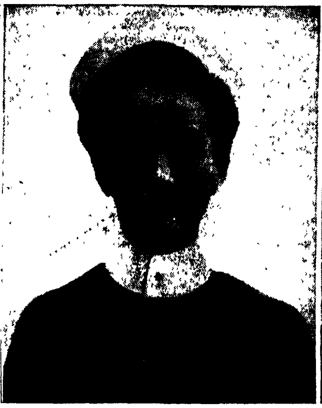
By MORRIS MONDZAK.

THE NEXT STORY OF SCIENCE IS ON PAGE 6437.

Lack of sunlight, caused by smoke in the air, is harmful to humans, animals and plants. Smoke consists of small particles of fuel which did not burn. Better methods of burning will prevent smoke and give more heat and power.



Culver Service
Joyce Kilmer.



Keystone View Co.
Edith Cavell.

Culver Service
Rupert Brooke.

THREE WHO DIED IN WORLD WAR I

RUPERT BROOKE, A BRITISH POET

WAR calls upon everyone to make sacrifices. Men of heroic mold lay down their lives gladly for their country or for their faith in a way of life—such as democracy. When young men of genius sacrifice their lives in war, their country and the world share in the sacrifice. This is especially true in the case of men whose genius has not come to full flower.

In the early months of World War I there died in the service of his country a young English poet of great promise. He left one volume of verse, and a grave in "some corner of a foreign field" marked "Rupert Brooke."

Rupert Brooke was born in 1887 at Rugby, under the shadow of the ivied turrets where that friend of boys, Dr. Thomas Arnold, was headmaster in the days of Tom Brown—a school which must long be noble because of the memory of that great teacher. In this school Rupert Brooke's father was an assistant teacher. "What a wonderful world it was to be born into, that little England that was mine, and how it seemed as if the days were not half long enough for one to taste all the joys they brought," he once said, looking back upon his early boyhood. All the things he saw and loved passed swiftly into his being. It is pleasant to think of him in that fair setting of Warwickshire fields under bright skies, with hedgerows all abloom, loving everything that makes the English summer sweet.

Rugby School did its best for this lad of promise. One of the Rugby boys said of him: "Rupert can't be spoiled or he would have been long ago. He never stops to bother about what people say of him. Of course a chap who can play football and carry off school honors at the same time has something better to think about."

From Rugby he went to King's College, Cambridge, where again he made many warm friends and won honors, chief of which was a fellowship which enabled him to continue his studies with extensive travel on the Continent. These seem to have been his chief life-assets: sound scholarship, a keen intelligence, a character well knit, rare physical comeliness, a gift of words, a poetic habit of mind, a sense of humor and an overpowering personality. He was, in short, a rare specimen of youthful manhood. We may not agree with Henry James, the novelist, who said of Rupert Brooke and his ambition to be a poet: "Anyone who can give such all-around satisfaction as a human being should not be encouraged to specialize. Surely one who can be so much that makes life worth while for everyone who knows him, ought not to have to struggle to do things." The world can hardly be sorry that Rupert Brooke loved work even as he loved so many other good things, and that the work he chose was that of a poet. Already in his college days he had produced some notable verse—verse remarkable not so much for sustained excellence as for frequent brilliant passages. He was not a great poet, but to become one seemed to be within his easy reach. We see him as a radiant youth mounting the hill of promise and standing at the doorway of attainment.

But there came the call to arms. He said grimly: "Well, if Armageddon's on, I suppose one should be there." To him, as to so many others, the outbreak of so relentless a war seemed to be the mysterious Armageddon foreshadowed in the Book of Revelation as the war of wars, when the "kings of the earth and the whole world" should gather for battle.

The first weeks of the war saw him in the trenches, in the futile defense of Antwerp. The terrors of war and the suffering which he saw raised him to new heights of manhood. This young poet-soldier, marching in night-retreat under a black sky, lighted only by the fitful glare of burning villages, saw the pathetic multitude of homeless fugitives filing eastward to uncertain welcome. He saw two small children trying to help their mother push a wheelbarrow piled with clothing on which sat the feeble, trembling grandmother; another family with their rescued belongings on a milk cart pulled by a panting dog and pushed by a small heavy-eyed lad who watched to see that nothing dropped by the way; aged peasants with bundles on their backs; sad-faced mothers wearily carrying babies and trying to cheer frightened children clinging to their skirts, all with the dazed look of those who flee from fire and flood, from all they knew as home into outer strangeness.

The following February he joined the hapless expedition to the Dardanelles. From no feeling of cowardice or morbidness he seemed to feel the approach of death, "Death with shadowy and relentless feet." But he went

> With unreluctant tread,
> Rose-crowned into the darkness.

He died aboard a hospital ship in the Mediterranean. His comrades bore his body a mile inland at night by torchlight, and buried it on the heights in an olive grove on the isle of Scyros on the twenty-third of April. A short time before, he had written the sonnet which you may read on page 3739.

The best for the sacrifice—his life, his genius, his all! But as a brother-poet sings,

> Fling yourself in the fire,
> Die with a song of spring,
> If die you must in the spring!

Is it not of such stuff that victory is made?

JOYCE KILMER, AN AMERICAN POET

IF there was any one thing that distinguished Joyce Kilmer, aside from the gift he possessed, it was a great enthusiasm and zest for living and doing things. It was this energy which enabled him to crowd into his short life such an immense amount of experience and accomplishment. He lived such a busy life that no one knew just how many offices he held, how much work he did, and often after a hard day he would spend half the night dictating to his secretary or to his wife, sometimes walking up and down the room with his baby on his arm at the same time. He seemed to grow older than his years, and he treated his co-workers, even men much older than himself, as if they were younger, calling them "children." Indeed, many men who lived twice as many years did not attain his knowledge of life.

Joyce Kilmer was born in New Brunswick, New Jersey, December 6, 1886. He attended Rutgers College, 1904-06, and received the degree of Bachelor of Arts from Columbia in 1908. As a student he did not shine, but was merely an average boy with a great interest in the college journals. Shortly after graduation he was married and taught Latin in high school, but about a year of teaching was sufficient to prove that that was not his field, and he went to New York, taking his wife and infant son. In quick succession he became the editor of a journal for horsemen, salesman in a bookstore and assistant editor in preparing a new edition of a dictionary. His energy on this last work was rewarded by rapid promotion, and in his assignments to verify dates, origins of customs and the like he made many acquaintances—people of all kinds and in all walks of life—and he found them all exciting and fascinating, as they found him charming and original.

Courtesy, Davey Tree Expert Co.

**"I think that I shall never see
A poem lovely as a tree."**

In 1912 he was employed as reviewer on the New York TIMES REVIEW, and a little later became a special writer on the New York TIMES SUNDAY MAGAZINE. He was delighted to be a newspaper man—a "hard newspaper man," he called himself. Everything that came to Joyce Kilmer, whether work, sorrow or joy, he met with interest and found valuable experience.

In 1913 appeared a book of poems which contained the famous TREES, which you may read on page 1138. If there had been no other fruit of Joyce Kilmer's life, this one poem would suffice to give him a place in the heart of humanity.

As his friends in the literary world began to know him better they saw in him more than a clever boy. He was a young man with the knowledge of one much older, with unlimited capacity for work, and with a look in his eyes which made a well-known writer say of him that he had a "hint of destiny": "We have all met young people who give us that—beautiful, brilliant, lovely-natured, so supernatural, and touched, too, with the finger of a moonlight that has written 'fated' upon their brows."

In the midst of this busy life the news came that the United States had entered the first World War. It would have been surprising if Joyce Kilmer had not been a fighter: he was always ready to go to battle in a just cause. And now, "one fight more, the best and the last." And so it proved. Three weeks after the declaration of war he enlisted in the 7th Regiment National Guard, New York, but a little later was transferred, at his own request, to the 69th, the famous "Rainbow Division."

When he reached France he wrote back with his usual enthusiasm that this was "the pleasantest war I have ever attended." He liked the country, the people and the war. He learned to sing the soldiers' songs and liked them, and was very proud of himself for learning all the little things a soldier has to know in war time.

Indifferent to any danger, he would crawl, without orders, through the barbed wires at night trying to locate the enemy; and in the morning he would be found applying to his superior officer for a new uniform.

On July 30, 1918, the battalion in which Joyce Kilmer served was not in the lead, and he offered his services to the major of the foremost battalion. In the fighting that day he met death. We feel no doubt that he went to that last meeting with all the eagerness and interest which characterized all his undertakings. Death had no terror for him, for he knew that beyond lay life in all its fullness.

EDITH CAVELL, A HEROIC NURSE

IN war time, when people make great sacrifices for their own country, one who lays down his or her life for all humanity, friend or foe, deserves universal and lasting admiration. The heroism of Edith Cavell, an English nurse, will never be forgotten.

To her, in Belgium in the first World War, it mattered not whether she was nursing friend or foe. She was the friend of all who needed her, and even Germans she nursed back to health. At the same time, she showed how brave a woman can be by helping a large number of Allied soldiers, who had recovered from their wounds, to escape across the Belgian frontier into Holland or France. Once free, they could rejoin their own armies. She also protected young Belgians from capture by the Germans for military service with the German army. She risked her life in doing this, and one day the Germans arrested her, and found her guilty of intentionally helping the enemy. For this they sentenced her to death "in the interests of the State."

THE GERMAN ARMY CARRIES OUT THE SENTENCE OF DEATH

The ambassadors of other nations appealed in vain against this bitter sentence, and in the early morning of October 11, 1915, a German firing party took Edith Cavell to a garden, where an officer took a pistol from his belt and shot her dead.

She died like a daughter of England. Too proud to feel the scorn of her enemies, too noble to hate them, she left this message, which will ring forever down the corridors of time:

> Standing as I do in view of God and Eternity, I realize that patriotism is not enough. I must have no hatred or bitterness towards anyone.

With this noble farewell to the world Edith Cavell reached the gate of heaven.

Her woman's heart, burning with brave design,
  Forgot the law, and when a man desired
  To play the man, her woman's soul was fired
To help him join again his country's battle line.

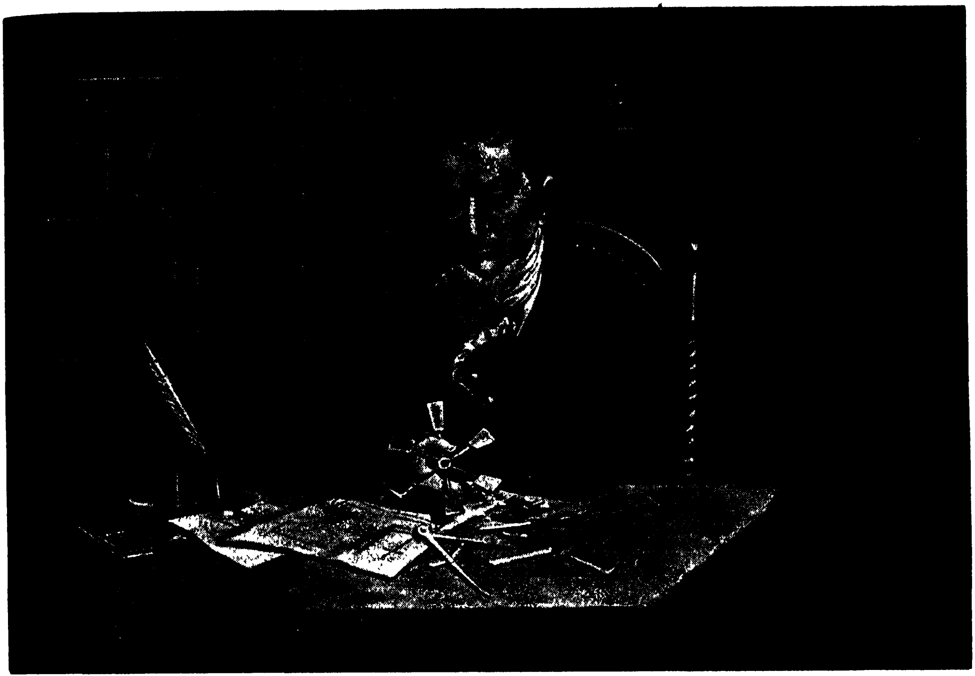
For that she died; the hands that she had healed
  Took her rare life; the heads that she had bound
  Plotted the giving of her own death wound.
Not womanhood could save; not womanhood could shield.

Her woman's gentle voice above this strife
  Wakes echo from the secret, golden bell
  Called conscience, so that time to come shall tell
How that most honored death helped men to nobler life.

THE NEXT STORY OF GOLDEN DEEDS IS ON PAGE 6879.

Ewing Galloway

The courage, nobility and fortitude of Edith Cavell touched the hearts and appealed to the imagination of people the world over. Many tributes have been paid to her memory: a snow-capped peak in the Canadian Rockies was named for her, and in London this monument reminds us of her martyrdom and of her great devotion to humanity.



Culver Service

Robert Fulton turns from painting pictures to designing plans for the building of a steamboat.

CONQUERORS *of the* SEA

THE seas and oceans of the world used to be barriers that kept apart the continents and islands, and their peoples. The dangers and difficulties and unknown terrors of the deep made seafaring a risky business. The best of the ships sailed by the courtesy of Neptune. The best of the captains, at the start of every voyage, earnestly hoped for good weather. But today, instead of being a barrier, the sea is a vast highway uniting all lands and peoples into one world.

This change has been brought about by the work of many men: inventors, practical men and scientists. Some of these men are unknown, or have left little record except their names. Many of them were not shipbuilders or navigators or even seafaring men, but nevertheless their inventions and discoveries helped to conquer the sea.

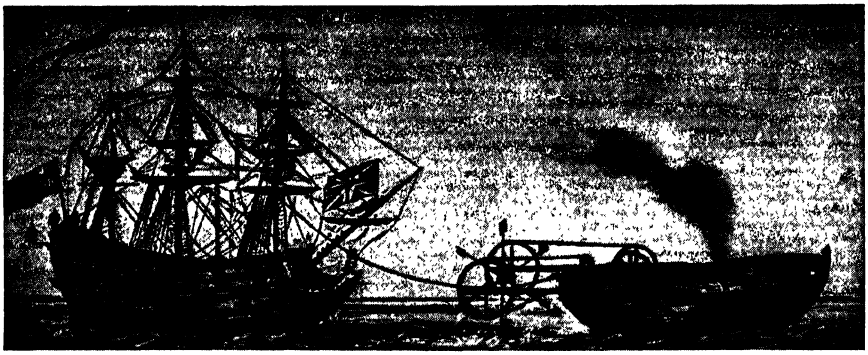
There are two general lines along which men advanced in their victory over the sea. One of these was the improvement in design and construction of ships.

Perhaps the most important changes in the whole art of shipbuilding came in the years following 1800. It was during this time that iron and steel replaced wood as the material from which ships were made, and then, too, that steam power took the place of sails.

Even before 1800, iron made its appearance on ships, being used to fasten the wooden parts together and to strengthen the framework. As early as 1777 there are accounts of the use of iron plates on canal boats. The beginning of iron ships is often given, though, as in 1818 when the iron barge Vulcan was built near Glasgow, Scotland.

There were prejudices and some real objections to the use of iron which were slow in being overcome. One objection in particular was the effect of the iron hull on the magnetic compass. The working and hammering of the iron in preparing the plates tends to magnetize the iron. In fact, an iron or steel ship is a mass of magnetized parts, and the effect is to deflect the needle

THE FIRST STEAMBOATS EVER MADE



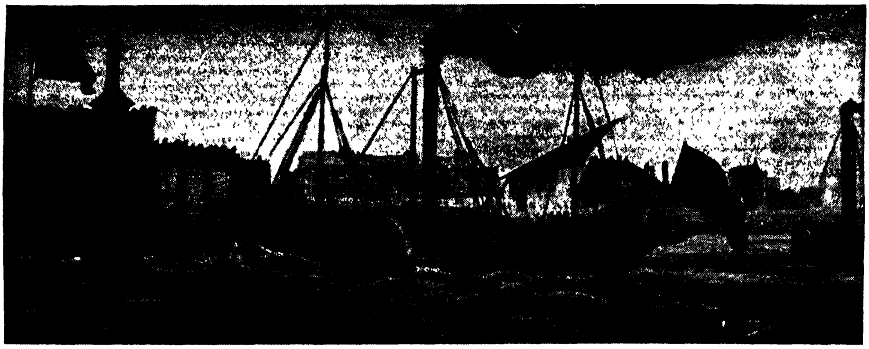
Although the honor of building the first steam-propelled vessel has been claimed for several different men, yet it probably was an Englishman named Jonathan Hulls who built the first steamboat, in the year 1736. Here we see Hulls' own drawings of his vessel, which are still in existence in the patent office.

One of the very early steamboats was built by a Scotsman, William Symington, in 1788. It had two paddle wheels right in the middle of the deck.

In 1803 Symington built a steamboat for Lord Dundas, and it towed barges on the Forth and Clyde Canal until its use was forbidden.

An American inventor, Robert Fulton, was the first to make steam navigation commercially successful, when in 1807 he launched the Clermont.

Another success was by a Scotsman, Henry Bell, who built this ship called the Comet in 1812. It scared ignorant people, who thought it a monster.



Inventors were now busy improving the steamboat, and steamers began to be built everywhere. When steamboats appeared on the Thames there was much opposition from the boatmen. By 1837, however, steamboats ran regularly from London to Margate. Here are two steamers approaching Margate Pier.

of the compass from pointing to the true north. In 1839, Sir G. B. Airy made experiments at Liverpool, England, on iron ships, and worked out rules for correcting the error of the compass. These rules, and improvements on them, have made it possible to overcome the difficulty.

MEN OF IDEAS WHO LED THE WAY WITH SUCCESSFUL EXPERIMENTS

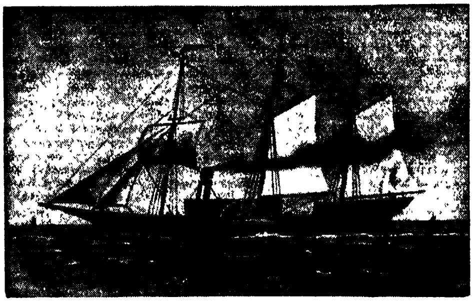
Among those men who blazed the trail in developing steam-powered ships was William Symington, a Scottish mechanic. He built several steamboats, and in 1802 one of these was successful in towing canal boats. The owners of the canal soon objected to the waves made by the steamboat, fearing that they would wash away the banks of the canal, and so the boat was abandoned.

Another builder was a Frenchman, Marquis de Jouffroy (1736-1832), who built three steamboats before 1785. The last of these was a real success, but the outbreak of the French Revolution forced the inventor to flee to America. When he returned to France, it was too late. Others had seized his ideas and carried them out. In America, James Rumsey and John Fitch made successful experiments. Fitch built experimental boats as early as 1785, and in 1790 one of his boats carried passengers on the Delaware River.

These are but a few of the outstanding men who led the way before the generally recognized inventor of the steamboat, Robert Fulton, came on the scene. Ill fortune, lack of money or public indifference prevented most of them from bringing their work to commercial success. Fulton was able to overcome these difficulties.

FULTON'S FOLLY AND THE BEGINNING OF RIVER STEAMBOAT TRAFFIC

Robert Fulton was born in Pennsylvania in 1765, and died in 1815. He was a portrait painter in his early years, and in 1786 he went to England to study under the American artist Benjamin West, who was living and working in London. The older man, impressed by Fulton's inventive genius, encouraged him to turn his attention to the building of a steamboat. Fulton soon gave up the idea of studying art. His mind teemed with invention. He constructed devices for improving canals, for cutting and polishing marble, for twisting rope, for spinning flax. He designed an iron bridge. He even made plans for a submarine which he submitted to Napoleon Bonaparte while on a visit to France, but nothing came of this.



The Royal William, built in Canada, the first vessel to cross the Atlantic using steam power all the way. This was in 1833. A tablet in honor of the men by "whose enterprise, courage and skill" the feat was accomplished is in the Parliament buildings in Ottawa.

It is said that Fulton saw William Symington's steamboat on one of his trips to England and that he copied that idea. But Fulton was no imitator. He profited by the experiences of those who went before him, but he had sound ideas of his own.

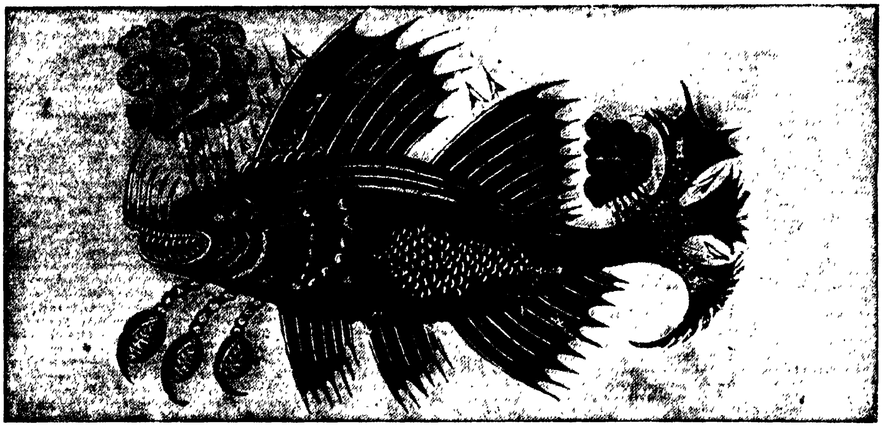
The first boat Fulton built was a failure. But he had great confidence in himself and, after careful planning, launched the Clermont at New York in 1807. The building of the boat was looked upon by the public, and even by his friends, as a useless scheme. It was the subject of much ridicule and was called Fulton's Folly. The inventor said later that all the time the boat was being built he never heard a single encouraging remark. When the Clermont set out on its first trip with passengers, it went a little way and then stopped. Everybody immediately thought that this was the end, but Fulton went below and put things in order. The boat then went on up the Hudson River in its journey to Albany—a distance of 150 miles in the amazing time of thirty-two hours!

Fulton did not live to see steam power on the Atlantic Ocean, but in 1811 he and his financial backers built a boat at Pittsburgh that helped open and settle the whole region west of the Alleghenies. It was named the New Orleans.

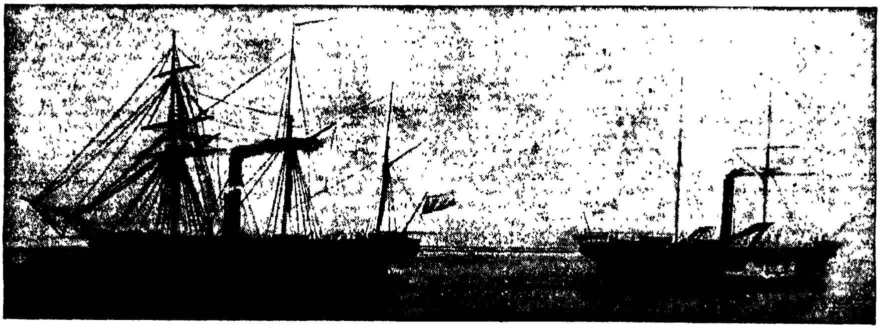
This marked the beginning of the vast steamboat traffic on the rivers of the west. The great side-wheel steamboats of the Mississippi and Ohio rivers puffed upstream and downstream with a constant flow of freight and passengers. In their day they were famous in song and fable. By the middle of the nineteenth century the old paddle-wheelers were built as long as 360 feet, with three or four decks and a speed of ten to twelve miles per hour. They were especially famous

HOW NAPOLEON LOST STEAM POWER

Fulton, the American, went to France and offered to build a steam navy for Napoleon. "Great man," said Fulton, "if you will support me, you can have the most powerful navy in the world." But French scientists said that steam would not drive a toy. Napoleon was in Elba when he first saw a steamboat.



Fulton also invented for Napoleon a submarine boat, and, with three friends, he remained under water for one hour. This boat was to fire a torpedo, or, as Fulton called it, "a carcase of gunpowder." Nothing came of the invention, and here we see a caricature of the submarine, published in America in 1811.



Upper and middle photographs copyrighted by The Century Company.

A great step forward was taken when men learned to drive a boat by a propeller at the end instead of by paddle wheels at the sides. Both methods had their supporters, and in 1845 there was a test, resulting in a triumph for the propeller. Two steamships, the Rattler, the first warship with a propeller, and the Alecto, a paddle-boat, had a tug-of-war, as shown here, and the Rattler pulled the Alecto easily.

for the excellence and abundance of their food. Rich furniture, colorful decorations and soothing dance orchestras made them the height of luxury for passengers of that time. In these things they far excelled the ocean-going passenger ships of that day.

Within a few years after Fulton's success, steamboats appeared on rivers and coastal waters of both Europe and America. Later, as the tide of settlers flowed westward, steamboats appeared on the Great Lakes of North America. Toward the end of the nineteenth century, however, both the lake and river boats lost most of their passenger traffic to the railroads. Most of the heavy river freight was switched to fleets of modern steel barges, pulled by towboats. On the Great Lakes, though, the freight traffic and the boats which carry it have increased in quantity and size. Today there are fleets of steamers, 10,000 to 15,000 tons each, carrying iron ore, coal, wheat and other heavy cargo between the lakes' ports. Freight carriage by water is still the cheapest means of quantity shipping.

In 1816 the first steam passenger boat crossed the English Channel, and in 1820 the first small iron steamship was put into service transporting people between London and Paris. But the first time that steam power was used in crossing the Atlantic came in 1819 when the little sailing ship Savannah performed the feat.

THE FIRST TRIP ACROSS THE ATLANTIC BY STEAM AND SAIL IN THE SAVANNAH

Constructed as an experiment for a group of Savannah, Georgia, business men by Francis Fickett in New York, the boat was equipped with an engine, a boiler and side paddle wheels, beside the usual sails. The Savannah made the trip from Savannah, Georgia, to Liverpool, England, in twenty-five days. Sometimes people belittle this achievement by pointing out that most of the voyage was made by sail. However, the experiment proved that it was practical to use steam power on the ocean because it was just the thing needed to overcome spells of adverse winds or calms.

In 1825 the British ship Enterprise made the trip from London to Calcutta, India, by way of the Cape of Good Hope, in 103 days. Sixty-four days of the run were made under steam power, and 39 days under sail. In 1830, this same ship crossed the Indian Ocean from Bombay, India, and steamed up the 1,200 miles of the Red Sea to the Isthmus of Suez in 54 days. This was before the Suez Canal was dug. It promised the success of the short route from England to India by way of the Red Sea and the Mediterranean; it saved a month's time, even though cargoes had to be transferred overland between these two seas. The performance also solved the problem of navigating the Red Sea. Heretofore the contrary winds, hidden reefs and intense heat had made the sea almost impossible for sailing vessels to navigate. See The Reign of the Wooden Ships, page 3909.

HOW THE PERILOUS CHALLENGE OF THE RED SEA WAS OVERCOME

One of the most troublesome feats that the ancient mariners had to perform was entering the Red Sea from the Indian Ocean. Because of the strong currents and unseen rocks which periled every vessel, this channel was called by the Arabs, Bab El Mandeb, meaning "Gateway of Tears, or Sorrows." But this and the other hazards of the Red Sea were conquered. Later, when the Suez Canal was built, a new chapter was penned in the story of the world's trade routes.

In 1833 the first ship to cross the Atlantic using steam power all the way was a Canadian vessel, the Royal William. It went from Quebec to London. The ships we have mentioned so far, however, were not real steamships. They were sailing vessels with steam power added in the best way possible at the time. It was not long, though, before a great British engineer and inventor undertook the task of making a real steamship, with specially designed engines and fuel space, to cross the Atlantic regularly. This was Sir Isambard K. Brunel (1806-59). He was the son of a famous engineer and had helped his father build a tunnel under the Thames River in England. Educated in Paris and later the builder of bridges, docks and many other notable structures, he became chief engineer in constructing the Great Western Railway in England. From this he turned to shipbuilding and marine engineering.

IRON STEAMERS CONQUER THE STORMY SEAS OF THE NORTH ATLANTIC

In 1838, a product of his efforts, the Great Western, became the first specially built steamer to span the Atlantic entirely under steam power. It arrived in New York from Bristol, England, after a fourteen-day voyage. Preceding this arrival by a day, a smaller ship, the Sirius, puffed into New York Harbor after a seventeen-day trip, starting from the port of Cork, in southern Ireland.

These voyages marked the conquest of the North Atlantic, where the prevailing and often strong winds come from the west. Adverse headwinds had often caused sailing ships going west to take roundabout routes of thirty to forty days, nearly twice the time it took to sail from west to east. Brunel also designed and built the first large iron steamer, the Great Britain. His last steamship was the Great Eastern, still larger, with fuel space for long round-trip voyages. His health broke and he died in 1845, just before the Great Eastern was launched.

WORLD TRADE PROSPERS AS LONGER VOYAGES ARE MADE POSSIBLE

The long delay in adopting steam power for ocean voyages was due to the problem of fuel, and to the lack of suitable engines, boilers and machinery. For many years after the introduction of steamships on the oceans, these ships were equipped with masts and sails to be used in case of fuel shortage or mechanical breakdown. Later in the nineteenth century, Great Britain took the lead in establishing coaling stations at the ports of her colonies and possessions all over the world trade routes. Thus, longer voyages were made possible.

The next man to make a great advance in the conquest of the sea was John Ericsson, born in Sweden in 1803. He was an officer in the engineering corps of the Swedish Army, but turned to inventing. He designed a locomotive, marine engines and other machines. In 1836, he patented a device which was to take the place of the old paddle wheel as a means of pushing a vessel through the water. It was a screw propeller, called simply a screw, for short, because its blades cut a spiral course in the water much the same as the threads of an ordinary screw in turning.

Ericsson, who was in London at the time, could interest neither the Royal Navy nor the merchant marine of England in the screw propeller. He came to the United States and convinced some of the Navy authorities that the mechanism had great possibilities. The Navy Department then authorized that two small iron ships be equipped with screw propellers for experimental purposes. The result was that Ericsson's invention was adopted for most of the new Navy ships. However, the United States merchant fleets, as well as those of Europe, continued to use the side paddle wheels for a good quarter of a century longer. The British Navy did turn to the use of the propeller, though, and by the time of the Crimean War in 1854 had a fleet of screw-driven warships. All, however, were of wood.

Incidentally, this John Ericsson was the same man who designed and built the ironclad warship Monitor for the Union Navy in the United States Civil War. The Monitor fought the Confederate ironclad Merrimac in a famous naval engagement that proved the power of iron warships. Ericsson also designed torpedoes and made several improvements in general ship construction. He died in New York in 1889, and his body was taken back to Sweden for burial at the request of the Swedish Government.

John Ericsson, inventor of the screw propeller.

The year 1880 may be spoken of as the beginning of the steel era in shipbuilding. Steel has many advantages over iron; and now, with modern methods of riveting and welding emphasizing those advantages further, the 5,000-ton ships of 1880 seem like peanuts on the ocean in comparison with the more than 80,000-ton luxury liners of today.

Before the end of the nineteenth century two more major improvements were made. The larger ocean liners began using two screw propellers, each driven by a separate engine. This added to power, and was a great advance in safety, for a breakdown of one engine still left ample power to navigate with the other engine and propeller. Now at last the emergency masts and sails were done away with.

The other improvement was the introduction of the steam turbine. This was an invention which made use of a very old principle, the same used in the ordinary windmill. In the turbine, high-pressure steam, many times more powerful than the air which pushes a windmill, rushes against steel blades set on a revolving shaft. This rotating shaft can then be used to turn the propeller directly, or it can drive a dynamo which would furnish electric current to run the propeller motor.

Great difficulties arose in making a practical steam turbine, as it must have the wheel fit very closely within the casing that incloses it. Then, too, the presence of such high pressures and temperatures cause many a problem. The advantage of the high pressure lies in the fact that the higher the pressure, the smaller the turbine. And on a ship, where every inch counts, this is very important. The final success of the turbine was due chiefly to the clever designs of Sir Charles A. Parsons, a noted English engineer.

When we consider the old-style reciprocating steam engine, the importance of the turbine becomes clear. The former has cylinders in which the steam moves pistons back and forth. To convert this to-and-fro motion into revolving motion, it is necessary to have strong rods connecting the piston with cranks on the driving shaft. We are all familiar with the ordinary locomotive engine and its number of rods and slides connecting with the driving wheels. This is one type of reciprocating steam engine, the horizontal type. New developments, however, have seen the steam turbine adapted to the railroad locomotive. See the color pictures on pages 406 and 407.

The marine reciprocating engine sits vertically; it has a number of steam cylinders to get all power possible from the steam. It also has a large number of heavy moving parts which set up vibrations. If you compare this with the turbine and its one revolving unit, the saving in weight, space and smoothness is great.

The twentieth century has seen oil largely take the place of coal for making steam in boilers. Oil has many great advantages; it is cleaner to handle, takes up less space and is easier to load because it is pumped through pipes and hose into fuel tanks. Taking on coal is a very dirty and laborious task, and continuously cleaning out ashes is likewise difficult. But not all ships have stopped burning coal. In addition to coaling stations all over the world, there are fuel-oil stations, supplied by oil-tank ships, known as tankers.

The next great conqueror of the sea who brought about advances in driving ships was Rudolf Diesel. He was a German, but was born in Paris in 1858. He was educated in England and in Munich, Germany. His great feat was designing an internal-combustion engine which, instead of using gasoline like the ordinary automobile or airplane engine, uses crude (partially refined) oil. In a car motor, as we know, gasoline is mixed with air and exploded in the cylinders by a spark. The Diesel compresses air and makes it very hot; then the crude oil is sprayed into the cylinder where the high temperature causes rapid combustion (burning) and the accompanying explosive push against the piston. Such an engine is simpler than the ordinary gasoline engine in that it does not require a separate sparking system. So the Diesel has proved to be a serious rival of the steam turbine in ships and of the gasoline motor in other fields. On shipboard it saves space and weight by doing away with enormous boilers; it saves money by using less expensive fuel; it provides greater safety in case of fire.

Diesel motors are generally connected to an electric generator which provides current to run the propeller motors and other motors throughout the ship. This is known as

An early American iron-clad built to the designs of John Ericsson in 1863.

Diesel-electric power; it has been installed in many large ocean liners, called motor ships. At the outbreak of World War II there was a world total of 178 ocean liners of 15,000 tons or more. Of these, 38 were motor ships using Diesel-electric power.

Diesel engines have many other uses. Today we see Diesel trucks on all our highways. Tomorrow we may see the Diesel engine driving our automobiles and airplanes, too, for it is being further developed and refined.

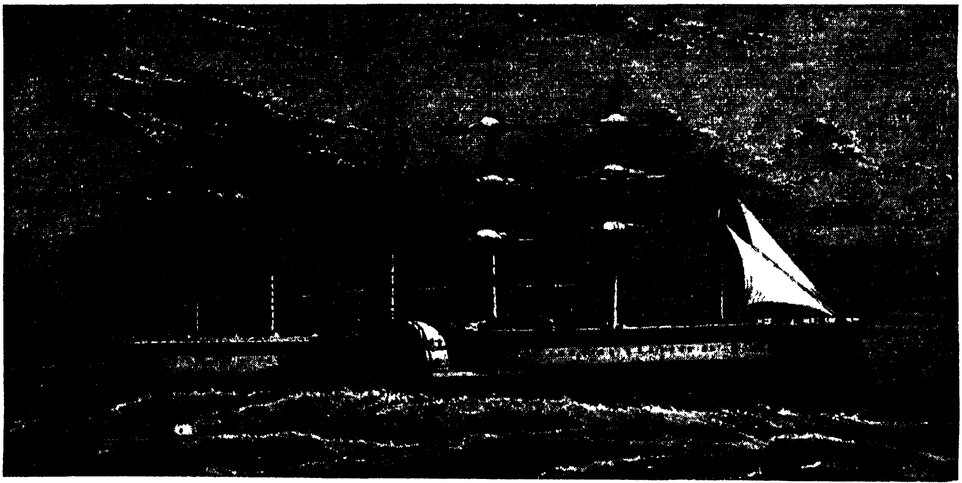
We have said that the conquest of the sea followed along two lines. The first had to do with making ships stronger and larger, and with developing engines for them. We now come to the second line of improvements, that which has to do with navigation and charting (sea-mapping). Thus is the sea made safer for travel and traffic.

The great explorers, such as Columbus and the host of men who followed him, were pathfinders of the seas. They found favorable sailing routes and made crude maps showing their courses. With each new land that they discovered came a chart of its coastlines and harbors. But the hazards of seafaring remained much the same long after these men had passed away. Maritime nations had made charts of coasts and seas with which they were familiar but there were vast unknown areas, treacherous currents and shifting winds that remained hidden till well into the nineteenth century. Our knowledge of the sea and its charting was incomplete, and our methods and instruments of navigation were neither dependable nor accurate.

The man who first began the systematic gathering of information about the seas and oceans, so that complete and accurate charting could be done, was an American naval officer named Matthew Fontaine Maury. He was born in Virginia in 1806, and died there in 1873. Entering the United States Navy as a cadet in 1825, he later took part in the famous four-year voyage of the U.S.S. Vincennes, which sailed round the globe. Soon afterward he wrote a long article on navigation which attracted much attention. He was then placed in charge of harbor and coastal surveys of the southern United States.

In 1839, Maury had an accident which permanently disabled him, and so in 1841 he was placed in charge of the office of charts and instruments in the Navy Department. This could have been just another easy job for a crippled man, but Maury went to work with great energy, gathering information about the world's seas.

He distributed large numbers of special "log books" to captains of United States vessels and those of other countries. In these books the captains wrote daily observations of wind, weather and any other important facts noted during a voyage. In nine years'



Culver Service

When the Great Eastern was launched at London in 1857, it was thought to be the greatest ship that could ever be developed. It cost nearly $5,000,000; its length was 680 feet; the engines were 1,000 horse power, and it had both paddle wheels and a propeller. Just in case the engines should fail, the Great Eastern carried also a full load of sail. In spite of the high hopes of its builders, it never was a successful passenger vessel, for there were many accidents. Its most useful work was in laying the Atlantic cable. The people of those days would have been astonished at the sight of the mammoth liners that sail our seas today.

time half a million reports were turned in to Maury from all over the world. His work attracted great interest in all maritime nations, and led to an international conference at Brussels in 1853. Here many nations agreed to co-operate in building up the science of ocean meteorology. (Meteorology is the science of weather.) Maury also tried to organize land meteorology, but the United States Government did not have any interest in it at that time.

In 1855, the Navy Department, in a fit of economy, put Maury on the retired list. But his work had become so valuable to navigation that great protests arose and he was given his job back again. He wrote a number of books on navigation and related subjects which were very valuable at that time. His book THE PHYSICAL GEOGRAPHY OF THE SEA was widely popular and was translated into several European languages.

The breaking out of the American Civil War was tragic to Maury. He could not bring himself to take part against his own people of Virginia, so he resigned his life's work. What he had accomplished was, however, so well established that the Office of Charts and Instruments continued to grow. It finally became the United States Naval Observatory and the Hydrographic Office of today.

Besides charts the navigator needs several instruments and devices to show his location at sea and the direction in which he is sailing. In this way he plots his course on the chart. Once out of sight of land there is nothing on the surface of the sea to tell his direction, location or speed at any time. The ancients sailed by observing the position of the sun, the moon and the stars. Modern navigators, until very recently, had to do likewise, but they had instruments by which they could make more accurate observations.

It is not certain who invented the magnetic compass, but whoever it was gave the world its basic direction-finding instrument. The compass needle always points to the north, thus establishing one definitely known factor for all calculations. This is not the true north but a varying point some distance from there, known as the magnetic north. We can see, then, that the needle will vary considerably from the true northerly direction, depending upon its position on the earth's surface. This variation also changes with time, weather and season of the year. These factors, and also the deviations caused by the iron and steel of a ship, must be taken into account if a navigator is to know his proper direction at all times.

A new kind of instrument which does not depend on magnetism for its direction-pointing is now in use. This is the gyrocompass. It is operated by electricity; and if it is set to point north, it will keep on pointing north no matter what direction the ship takes. Of course, the original setting must be made by referring to a magnetic compass.

Courtesy, Simmons-Boardman Publishing Corp.

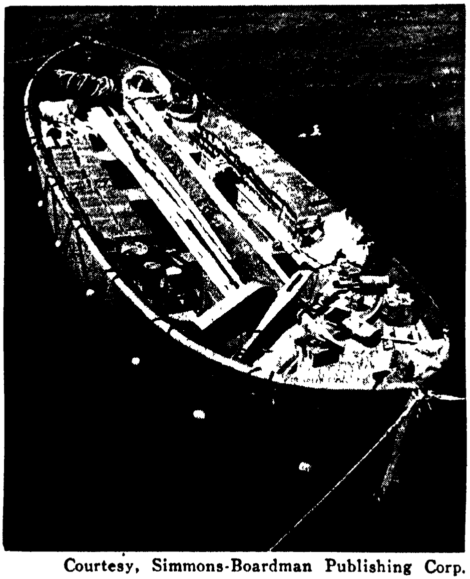
The laying of the keel of the first Victory Ship on November 19, 1943, marked the beginning of another brilliant chapter in United States Maritime history. The country's shipyards broke all records for the construction of these sturdy cargo vessels which helped to win World War II.

However, the gyrocompass has the great advantage of not shaking and moving easily with the slightest motion, as does the magnetic compass.

The basis of the gyrocompass is the gyroscope, about which you may read in another article. It was invented by Elmer Ambrose Sperry, born at Cortlandt, New York, in 1860, and educated at the State Normal and Training School, and Cornell University. He also invented the gyropilot, which steers a ship accurately in the direction it is set without anyone having to touch the helm (steering-wheel system). Another of his inventions is the ship stabilizer. This is a large gyroscope fastened in the ship to keep it from rolling in heavy seas, or when the ship is lightly loaded and riding high in the water.

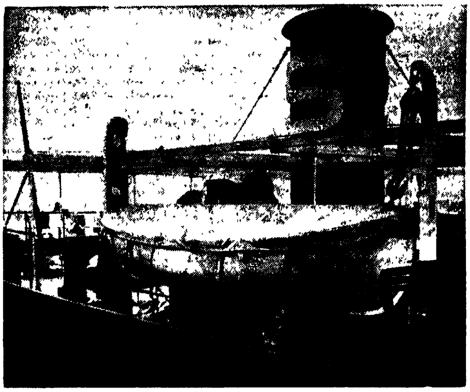
Sperry also invented a high-intensity searchlight, control apparatus for firing guns (fire control) and many other devices for the United States Navy. He took out more than 400 patents, received many decorations and awards and was a member of the United States Naval Consulting Board until his death in 1931.

While a compass will tell the direction in which a ship is going, other instruments are needed to find its location. With this known, the distance to any port can be measured on the chart. Navigators use three aids to get this location. They are: the sextant, the nautical almanac and the chronometer. The sextant is used to find the height of the sun, or the moon, or certain stars above the horizon. The nautical almanac is a book issued every year by various governments, giving tables which help the navigator to work out his position from observations made with the sextant. The chronometer is just a big, very accurate watch, specially made.



Courtesy, Simmons-Boardman Publishing Corp.

The United States Coast Guard designed this lifeboat in which not a single inch of space is wasted. It carries 29 persons in addition to 50 gallons of gasoline, 430 quarts of water, oars, sails, masts, food rations, tools, charts, signal devices, medical supplies, antenna, compass, and so on. These items are stored in watertight compartments under the deck. There are chemical devices to make "fresh" water out of sea water.



Courtesy, Simmons-Boardman Publishing Corp.

A modern lifeboat on a small tanker. It is swung on davits, so that it can be quickly put down over the side, in case of any accident to the ship.

These things do very well to find the location of a ship when the weather is clear. However, in cloudy weather no observations of the sun, or the moon, or the stars can be made with them, and the location of the ship can only be estimated. As a result of the development of radar, some electronic devices can now be used to get the accurate position of ships, regardless of clouds or fogs. These inventions make navigation even more safe.

Radar is a coined, or made-up word, originally standing for *Ra*dio *D*etection *a*nd *R*anging. Radar equipment was first used at the beginning of the war by the British, to detect enemy airplanes long before they came in sight; warning could then be given to defending anti-aircraft batteries and airplanes. Since then, radar has greatly outgrown its original meaning. Now it does not mean any one mechanism or device but, rather, a general field of electronics.

Wireless telegraphy, radio broadcasting, radiophone and television all send electronic waves from a sending station to receiving stations. They may be called one-way systems of sending waves. Radar goes farther. It sends the waves out, and then they are reflected back to the sending station. It may be called a two-way system, and is both a sending and receiving station.

Our eyes see things by means of visible light-waves, but electronic or radio waves are invisible. They can be seen only by using a form of television screen known in electronics as an oscilloscope, or more simply, a scope.

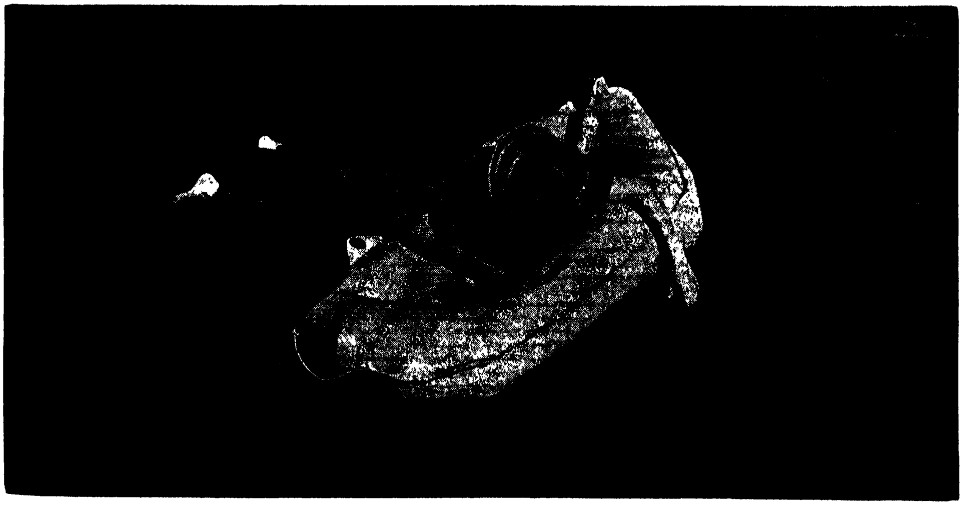
What is most important is that electronic waves will go through fog, clouds, and smoke; they will reflect back at night as well as in the daytime. And, too, the direction from which they are reflected may be observed quite accurately.

When an airplane directs a radar beam down on the land, houses, woods, factories, bridges, streams, and so on, give better reflections than the earth itself; so they show up better on the scope. A light-and-dark outline picture is presented, looking something like a map.

When a ship sends out beams, the reflections from other ships, coastlines, harbor buoys, lighthouses, reefs, and so on, are mirrored on the scope more distinctly and in sharper outline than just the water. A dense fog or a black night makes no difference. During the war, when there were blackouts and fogs, ships equipped with radar were able to steam at full speed through New York Bay and up the Hudson River to their docks without hitting anything. All obstructions appeared on the scope like subjects in a photograph as the ship went on: shore lines, channel markers, anchored ships, harbor tugs and docks. The opening in the submarine nets was easily found, and when the scope showed that the ship was close to where her dock should be, why, there it was, looming dimly out of the fog. Ships often saved as much as two days that would otherwise have been spent waiting outside the harbor for the fog to lift.

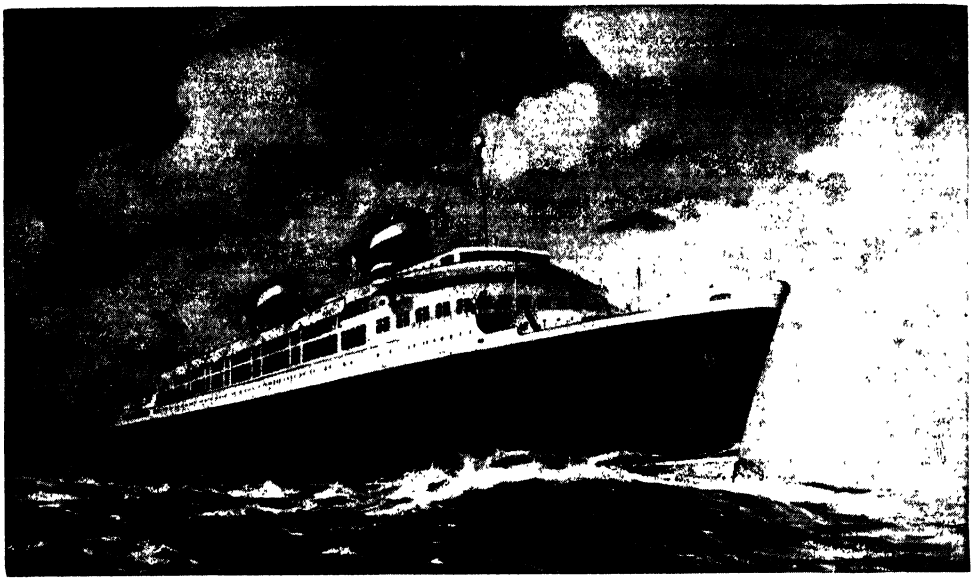
Another useful piece of equipment that has been developed is the radio direction finder, by means of which ships far out at sea can get their exact position when it is impossible to use the sextant. Special radio stations are established in various locations along coastlines. When a ship wants to get its position, it radios a message to each of two land stations. The operators there note the exact direction from which the message came, and then each radios back, telling the ship in what direction it lies from his station. All the direction-finding stations are shown on the navigator's charts. So, all he has to do is draw lines from the shore stations in the directions given. Where the lines cross is the exact location of the ship.

The developments in radio and radar are the results of unceasing work by literally thousands of scientists and technicians in various countries of the world. The Allies and the Axis countries both had some forms of radar, but the greatest advances were made by Great Britain and the United States. These two countries shared their inventions and discoveries in the field of electronics.



U. S. Navy photo

Rubber life-rafts like this one have saved the lives of many fliers whose planes have been lost at sea.



Courtesy, U. S. Lines

A painting, by Fred S. Hoertz, of the United States liner America, rated at 30,000 gross tons, the largest passenger ship ever built in the United States. Launched in 1940, the ship is 923 feet long, 92 feet wide, with a speed of about 22 knots and accommodations for 1219 passengers and a crew of 639.

In 1940 a group of British scientists went to the United States to arrange an exchange of scientific information. This led to the setting up by President Roosevelt of the National Defense Research Committee, which later became a part of the Office of Scientific Research and Development. This committee started to work in November of 1940. At the end of the war it had nearly 4,000 scientists and technicians working in Washington and in the country's leading universities and industrial organizations.

The British and the Americans had begun to develop electronic devices for detecting airplanes about 1930, working independently of one another. By the time the war began, the British had made the greatest practical advances in airplane detection, but the Americans had done more to adapt radar to warships. By combining their experiences in America, out of range of the German planes and rocket bombs, every use of radar was developed to the highest extent. To name the men who took part in this development would be to name most of the great scientists in the fields of physics, electricity and allied subjects, both in Great Britain and in the United States.

There have been many other modern improvements in the weapons we use in our eternal fight against the sea. Besides the usual lifebelts, many ships now carry unsinkable lifeboats. They are equipped with oars, sails or motors, and many of them have small radio sets. Naturally, containers of water and food are included.

A new life-raft is the rubber type which carries stored in it paddles, a small mast and sail, a supply of concentrated food, water and other essential articles.

To meet the problem of fresh water a small sea-water purifier has been developed. It is a special kind of bag, holding more than a pint. Sea water is put into it, together with a small chemical tablet. The bag is then closed and shaken to dissolve the tablet. In about twenty minutes the chemicals have settled the salts to the bottom like pebbles. You drink the water through a nozzle, and the harmful ingredients are held back by a filter. This small outfit, with a dozen tablets or more, can be put into anyone's pocket. It was invented by the Permutet Company of New York for the seaplanes of the United States air forces, but it can also be used in ships' lifeboats.

Conquering the sea has been the accomplishment of men and machines. It has been the story of progress against other men, against ignorance, prejudice, ill fortune and the wiles of nature. What has been done is written gloriously in the pages of history. What is to come—who knows?

THE NEXT STORY OF FAMILIAR THINGS IS ON PAGE 6744.

The Bettmann Archive

Illustration from Ludwig Uhland's poem, The Young King and the Shepherdess. Uhland, a poet of the nineteenth century, wrote about the romance and beauty of the Middle Ages.

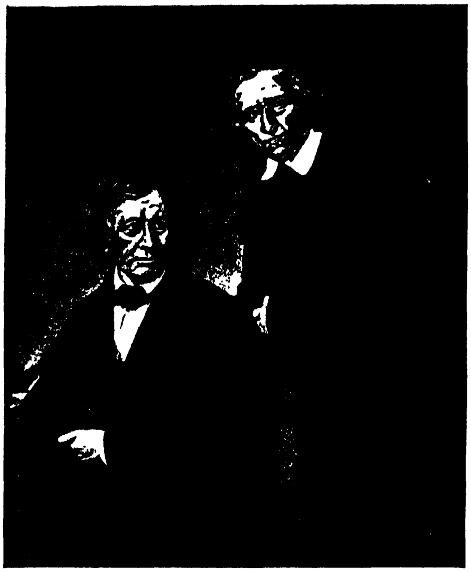
THE LITERATURE OF GERMANY: II

THE storm and stress movement died out not long after Goethe and Schiller deserted it. By the beginning of the nineteenth century a new movement, called Romanticism, had come to the fore. This was a confused affair, which meant different things to different men. For example, such novels as William Lovell, by Johann Ludwig Tieck (1773-1853), and Lucinde, by Karl Wilhelm Friedrich von Schlegel (1772-1829) might have been written by men of the storm and stress era. They are violent, melodramatic and uphold the right of the individual to do what he chooses.

Other Romantics heeded the teachings of the great philosopher Immanuel Kant (1724-1804), who stressed the idea of duty. They thought that the individual should think not so much of his own welfare as of that of the entire nation. Practically all Romantics, however, were united in their admiration for medieval German literature.

In the first decade of the nineteenth century German Romanticism became very patriotic. The military might of Prussia had been humbled by Napoleon; the other German states had had to acknowledge his mastery. The philosopher Johann Gottlieb Fichte (1762-1814) had protested against the acceptance of a foreign yoke. He had urged Germans to train their youth to devote themselves to their country so that it might one day be free. The Romantics hailed Fichte's stand; they urged Germans to unite against the foreign foe.

The spirit of burning patriotism is to be found in the stirring poems of Ernst Moritz Arndt (1769-1860), Theodor Koerner (1791-1813) and Friedrich Rueckert (1788-1866). It is also to be found in the later



From an old print

Jakob Ludwig Karl Grimm and Wilhelm Karl Grimm, the brothers who gave us Grimm's Fairy Tales.

works of a greater man than these—the brilliant but eccentric Heinrich von Kleist (1777-1811). Kleist had resigned his commission in the Prussian army to devote himself to literature. He had written several striking dramas and novels, including the great novel called The Broken Jug, a realistic picture of Dutch life.

When the German people rose at last against Napoleon, Kleist wrote a stirring play, Hermann's Battle, which dealt with the revolt of the Germans against the Romans in the first century A.D. In other works, too—in the pamphlet called Catechism for Germans and in the poem The Prince of Homburg—he struck the note of patriotism. These two works were not published until after his death. In 1811, Kleist determined to put his sword at his country's service; but, though he received a commission, he was too poor to buy a uniform. In despair he took his own life.

Certain Romantics inspired a warmer national pride in Germany by revealing the greatness of German medieval writings. The Grimm brothers, Jakob (1785-1863) and Wilhelm (1786-1859), played a prominent part in this movement. They wrote many learned books about the mythology, the hero-saga (stories of legendary heroes) and the medieval poetry of the Germans. These writings are of interest chiefly to those who make a deep study of literature and of languages. The Grimm brothers are known to boys and girls the world over, however, for their delightful collection of old German fairy tales. This collection includes such favorites as Hansel and Gretel, Tom Thumb and The Frog Prince.

The poet Johann Ludwig Uhland (1787-1862) also opened the eyes of the Germans to their past. The spirit of the Middle Ages breathes again in such poems as Siegfried's Sword, The Singer's Love and The Minstrel's Curse. Other poems of his reflect the humble joys and sorrows of innkeepers and mountaineers and shepherds of the poet's own day. Among the most beloved are The Landlady's Daughter and The Good Comrade. One of the richest expressions of the romantic movement is his Castle by the Sea. Longfellow translated many of his songs into English.

Uhland became the leader of a school of poetry called the Swabian School, which carried on the traditions of Romanticism. One of the finest poets of this group was Eduard Moerike (1804-75). His verses are marked by simplicity and depth of feeling; the ballad called Fair Rotraut is a universal favorite. Moerike also wrote an interesting novel of artist life, Painter Nolten, and a

From an old print

Immanuel Kant thought duty should rule our lives. His great work is The Critique of Pure Reason.

number of short stories. Other members of the Swabian School were the poets Andreas J. Kerner (1786-1862) and G. Schwab (1792-1850).

In 1814 Napoleon was forced to abdicate and the German states were free at last. Yet the Germans had recovered their national freedom only to find themselves oppressed by rulers who governed like dictators and who forbade freedom of speech.

Heinrich Heine, one of the world's great poets.

Charles X sat upon the throne of France. He was a king "of the old school." He thought that he was appointed by God to rule, and that he owed his people no share in the government. In 1830, the French people drove him from the throne and set up a more democratic monarch. The liberals of Germany now took heart; they urged their countrymen to follow the example of the French. A group of liberal writers, called Young Germany, became particularly active in the reform movement. Their leader was the poet Heinrich Heine (1797, or perhaps 1799-1856).

Of Jewish birth, Heine had become a Christian because he thought that a Jew could never win proper recognition in Europe. He won brilliant success in his youth with the great poetical collection called The Book of Songs and with his Pictures of Travel, an entertaining account of his journeys. Yet he could never overcome the prejudice against his race. At last he left Germany, never to return; he spent the last years of his life in Paris. In that city he wrote some of his finest verse—New Verses and The Romancero. He also wrote many political works in which he bitterly attacked the dictatorial policies of the German rulers. He labored continually to promote an understanding between Germany and France.

Heine is one of Germany's greatest lyric poets. He rivals Goethe in his superb command of language and his vivid imagination. His poetry is sometimes marred, however, by a rather unpleasant note of sarcasm. This unhappy man could not help setting down in his verses the bitterness caused by his many disappointments. Yet many of his poems are marked by great simplicity and tenderness. Such are the poems—Lorelei, Pretty Fisher Maiden and To My Sister—given in our Book of Poetry.

Another important member of the Young Germany group was Ludwig Boerne (1786-1837). His real name was Loeb Baruch. He expressed his admiration for French liberalism in his eloquent Letters from Paris; he urged reform in his vigorous novel Wally the Doubter. He wrote a number of satirical sketches; among these is the extremely witty Art of Becoming an Author in Three Days.

The dramatist and novelist Karl Lebecht Immermann (1794-1840) is generally counted as one of the Young Germany group. Of his many dramas the most popular, perhaps, is the beautiful dramatic poem Merlin. Immermann is best known, however, for his satirical novel Muenchhausen, which deals with the follies of the upper middle class of the author's day.

Franz Grillparzer, an Austrian playwright.

Though he was a contemporary of the Young Germans, the Austrian dramatist Franz Grillparzer (1791-1872) belonged to

SCENE FROM A STORY BY IMMERMANN

© Brown Brothers, New York

Karl Leberecht Immermann was a writer of novels and plays. One of his most important novels was Muenchhausen. In it he makes fun of the silly pretensions of the upper and middle classes of the day—the people who thought more of money and so-called "good birth" than of real worth. The charming story of The Upper Farm is inserted in the novel. The above picture shows a scene from The Upper Farm.

no particular school. He writes in a serenely classical vein that recalls the later writings of Goethe. Although two fine plays of his—King Ottokar's Fortune and End, and A Faithful Servant—are based on Austro-Hungarian history, Grillparzer's best plays—The Ancestress, The Golden Fleece and The Waves of the Sea and of Love—have a Greek background. The last-named drama, his masterpiece, is based on the legend of Hero and Leander (see Index, under Hero).

Like Grillparzer, August von Platen-Hallermund (1796-1835) remained aloof from all literary groups. His poetry is marked by flawless form and an impersonal approach; few German poets have revealed so little of themselves in their verses as Platen. Among the finest of his poetical collections are his Sonnets of Venice and Polish Songs.

HOW RICHARD WAGNER, AUTHOR AND COMPOSER, WAS SENT INTO EXILE

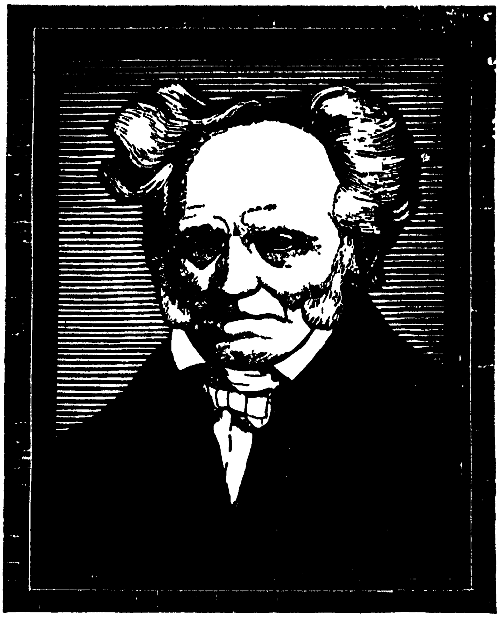
In the forties the struggle for political freedom entered a decisive phase. Revolution swept over Germany in 1848, as it swept over other parts of Europe. In Germany the forces of repression were triumphant. The revolution was crushed and the liberals who had taken part in it were slain or imprisoned or driven into exile. Among the exiles was Richard Wagner (1813-83), who had already composed several of his great operas, or musical dramas.

SCHOPENHAUER, WHOSE WRITINGS LOOK ON THE DARK SIDE OF LIFE

The fifties and sixties were marked by a general feeling of depression; at this time the pessimistic writings of the philosopher Arthur Schopenhauer (1788-1860) gained wide influence. However, this was a rather fruitful period in the history of German literature; a number of talented dramatists and novelists flourished.

The principal figure among the writers of this time is perhaps the dramatist Friedrich Hebbel (1813-63). He had a sad childhood and youth, and the gloom of his early years is reflected in his plays, the most important of which are Judith, Mary Magdalene and Agnes Bernauer. Hebbel laid the foundations for the social drama—that is, the type of play which interests itself in social conditions rather than in individuals. Hebbel also wrote a Nibelungen trilogy—a series of three plays based on the old Song of the Nibelungs.

The plays of Otto Ludwig (1813-65) are marked by a wealth of picturesque detail; they include The Maccabees and The Hereditary Forester. Gustav Freytag (1816-95), a busy editor, wrote a number of first-rate plays, including The Journalist, a great novel, Debit and Credit, and some important critical works.



Arthur Schopenhauer, the philosopher of gloom.

The Swiss writer Gottfried Keller (1819-90), was perhaps the best writer of short stories in German literature. These stories deal chiefly with the doings of plain middle class people. The background of these tales is sketched in with the greatest of care; the characters are vividly portrayed. Among the best of these stories are Clothes Make the Man, Romeo and Juliet in the Village and The Poor Baroness. Keller also wrote considerable poetry and an autobiography, which the author called Green Henry.

In the Franco-Prussian War (1870-71) Germany conquered France and became the leading country on the European continent. Germany's industries and her commerce expanded greatly; she began to acquire great colonial possessions. This was a realistic age when Germans attacked with great energy the problems of everyday life. Realism, too, was the keynote of much of the literature produced in the last part of the nineteenth century. This realism is sometimes called naturalism; it was greatly influenced by the works of the Frenchman, Zola (see page 6718) and the Norwegian dramatist and social thinker, Henrik Ibsen.

In realistic writing you will find careful, exact descriptions. Every detail of a person's appearance, or of a scene or an action is carefully set down. Little is left to the reader's imagination. The realistic writers, in almost every country, at this time were generally sad or bitter men and their writings were inclined to be gloomy. They did not write to entertain readers, but to make people think. French literature during these years bore the same stamp.

THE POWERFUL, SERIOUS NOVELS OF HERMANN SUDERMANN

The greatest German novelist of this period was Hermann Sudermann (1857-1928). Dame Care and Regina are powerful novels, realistic in background and plainly setting forth problems and evils of the day. Theodor Fontane (1819-98), a man of French Huguenot descent, wrote much before the realistic age had set in, but he is chiefly remembered for the realistic novels he wrote in the eighties and nineties—Effie Briest, Stine, Cecile and Grete Minde.

Wilhelm von Polenz (1861-1903) wrote effective studies of German country life—The Pastor of Breitendorf, Farmer Buettner and The Master of Grabenhagen.

It was in the drama that naturalism won its most notable success. Gerhart Hauptmann (1862-1946) made a profound study of social conditions in his plays; no grim details were spared. To quote one of Hauptmann's characters, the dramatist "peered into the terrible abyss of the wretchedness of our time." He discussed conditions among the peasants in Before Dawn, the misery of the Silesian linen-weavers in The Weavers, the sufferings of a scholar who cannot find intellectual companionship in Lonely People. In other plays of Hauptmann, however, naturalism was replaced by highly poetical symbolism, far removed from reality. Such was the beautiful play called The Sunken Bell. This sets forth, in the form of a dramatic allegory, the dangers of aiming too high.

THE PLAYS OF SUDERMANN WERE AS SOLEMN AS HIS NOVELS

Another famous writer of naturalist dramas was Hermann Sudermann, who, as we saw, was also a novelist of note. In the plays Honor, Sodom's End and Homeland (called Magda in the English version of the play), Sudermann stresses the right of the artist to lead a freer life than the people who merely earn their living and who create nothing artistic. Among Sudermann's other dramatic works are Morituri, a series of three one-act plays, and a dramatic cycle, The World Made Godless.

NIETZSCHE, WHO ADMIRED POWER AND TALKED OF "SUPERMEN"

Like the naturalists, the philosopher Friedrich Nietzsche (1844-1900) attacked the civilization of his time. He denounced it, however, not because it was bad but because it was weak. Nietzsche was a great admirer of power—power that acknowledges no such "weaknesses" as kindliness and compassion. Nietzsche developed the idea of a superman—the man of the future, who would develop all his faculties, disregarding whatever misery he might cause to others. Nietzsche's ideas are expressed in such treatises as Beyond Good and Evil and The Genealogy of Morals. His most perfect work is Thus Spake Zarathustra; here his doctrines are presented in beautiful rhythmic prose. Nietzsche's idea of the superman, distorted so as to make the superman a German, was taken over by certain groups of German nationalists.

THE CHANGE THAT CAME IN THE EARLY YEARS OF THE NEW CENTURY

The extreme realism of the naturalists was replaced by a more restrained form of realism in the first years of the twentieth century. This new kind of realism was sometimes called impressionism. Its writers did not go into sharp, precise details in their work, but sought rather to give general broad views, or impressions, leaving each reader to fill in the details for himself. The impressionists, on the whole, had a more hopeful view of man and of civilization than the naturalists.

The greatest poet of the age was Stefan George (1868-1933). He headed a group of poets who broke not only with naturalism but with all artificial standards. George's poetry deals with a wide variety of subjects —love, fate, home, faith, hope, disappointment. It is true lyric poetry, deeply felt and set forth in beautiful verse. George's only serious rival was Rainer Maria Rilke (1875-1926), a native of Prague, in Bohemia. Rilke strikes a mystic note in his polished verses.

The German novel is well represented in the twentieth century. There is a strong note of idealism in the powerful novels of Gustav Frenssen (1863-), a pastor who withdrew from the pulpit to devote himself to writing. His masterpiece is Joern Uhl, the story of a peasant who struggles to rise above the poverty of his class and who at last succeeds. A similar theme is dealt with in Klaus Hinrich Baas. Other important novels of Frenssen's are Peter Moor's Trip to the Southwest and The Fall of Anna Hollmann. He also wrote plays and sermons.

TWO NOVELISTS WHO ARE BROTHERS, THOMAS AND HEINRICH MANN

Thomas Mann (1875-) established his reputation in 1901 with Buddenbrooks, the account of the decay of a well-to-do family. He added to his fame with other masterpieces such as Death in Venice, The Magic Mountain, Joseph and His Brethren and Joseph in Egypt. He is considered by some as the greatest German novelist of the century. Mann's brother Heinrich (1871-) also wrote a number of outstanding novels. The best are The Goddesses, The Hunt for Love and Between the Races.

The Austrian novelist and dramatist Arthur Schnitzler (1862-1931) wrote novels, such as The Road to the Open and The Lonely Way, that made a deep study of problems of the time. His plays are often light and graceful, sometimes satirical and even somewhat scandalous.

Many dramatists now break loose entirely from the realistic traditions of the naturalists. Instead of giving an exact copy of the life about them, they try to set forth the inner meaning of what we see or hear or feel. Allegory and symbolism often express this inner meaning. Hauptmann's Sunken Bell had pointed the way as early as 1896; not a few of his later plays show this same tendency. It is also to be found in such dramas as The Beggar, by Reinhard Sorge (1892-1916), From Morn to Midnight, by Georg Kaiser (1878-1945) and A Race, by Fritz von Unruh (1885-).

THE SAD NOVELS THAT FOLLOWED THE FIRST WORLD WAR

World War I (1914-18) had a far-reaching effect on German literature. The crushing defeat of the Germans in that conflict dampened the spirit of German nationalism. There is very little enthusiasm for the superman doctrine in such war novels as The Case of Sergeant Grischa, by Arnold Zweig (1887-), All Quiet on the Western Front, by Erich Maria Remarque (1898-), whose real name is Kramer, and The Pure in Heart, by Franz Werfel (1890-1945). Germans were deeply affected not only by the war itself but by the terrible privations that followed, so compassionately described in Little Man, What Now? by Hans Fallada, whose real name was Rudolph Ditzen (1893-1947).

German literature was now more cosmopolitan than ever before. It interested itself in the problems of civilization in Europe. When it concerned itself with Germany, it was generally in a spirit of unprejudiced inquiry.

STUDIES OF GREAT MEN BY LUDWIG AND ZWEIG

In this period Jakob Wassermann (1873-1934) wrote such novels as Caspar Hauser, Oberlin's Three Stages and Faber, in which man is shown in conflict with himself and with the modern world. Emil Ludwig (1881-1948) found in many different countries and ages the heroes of his remarkable biographical studies—Napoleon, William Hohenzollern, Goethe, Lincoln, Genius and Character. Stephan Zweig (1881-1942) also excelled in this field; his most important works include Paul Verlaine, Mary Queen of Scots and Romain Rolland. He was also a critic, novelist and dramatist of note. Franz Werfel, who had written the fine war novel The Pure in Heart, turned to Armenia for the inspiration of his even greater Forty Days of Musa Dagh. Bernhard Kellermann (1879-) dealt with social problems in a strikingly effective way in such novels as The Ninth of November, The Saints and The Schellenberg Brothers. Lion Feuchtwanger (1884-) delved in Germany's past for some of his most powerful novels. His masterpiece is The Jew Suess (also called Power in the English translation), a not very flattering picture of eighteenth century Germany. Another of this writer's novels of the past is The Ugly Duchess. Feuchtwanger came to America in 1940.

WITH THE COMING OF THE NAZIS GERMAN LITERATURE CEASED TO BE FREE

With the rise of nazism, all German art suffered a profound shock. Many of Germany's greatest men of letters were either forced into exile or left Germany of their own accord as a protest against conditions in their country. The Nazis determined to rule literature as they ruled all the other elements of the population. With Dr. Josef Goebbels as literary dictator, German writing was fitted into the nazi pattern. Much of the new literature produced in Germany during the nazi period was mere propaganda, without distinction or value. The end of the nazi power found German art at its lowest ebb. Let us hope that in the years ahead, the writers of Germany may again produce works worthy of free men.

THE NEXT STORY OF LITERATURE IS ON PAGE 6465.

MOSQUITOES AND FLIES

Sperry Gyroscope Co.
A drone fly, greatly enlarged, its gauzy wings spread in flight.

AMONG the insects we class as harmful to man are the mosquitoes and the flies. These are harmful, of course, in varying degree. Some mosquitoes, for example, are irritating. Those we fear most, as transmitters of malaria or of yellow-fever germs, do so by picking up from man or beast parasites that cause the diseases, and transporting the parasites to other men or animals.

Let us see how the cycle works, in the case of malaria. Certain mosquitoes, called anopheles, may bite a man who has malaria. A living parasite that carries the malaria germ passes from the man's blood into the mosquito's body, multiplies there, and is passed on into the system of the next person bitten. That person becomes a carrier of the disease and can infect numerous other mosquitoes.

The word malaria itself tells the tale of the old belief as to the disease that it describes. Men thought that marsh air was bad to breathe and that it brought malaria. The word malaria means simply "bad air." As a fact, however, it was the water, the marshes, the sodden banks of rivers and lakes, the puddles and muddy pools of filthy cities and villages that were the breeding-places of the fatal mosquitoes. Malaria and mosquitoes vanished together from a district when cleanliness took the place of neglect, and bog was converted into dry land.

The tracking-down of the germs of malaria and yellow fever is a triumph of our own time. The building of the Panama Canal was one of the greatest engineering achievements the world has seen. The conquest of the little mosquito which had so long kept the engineering back was a performance of even greater importance. That conquest had its effect in every tropical land to which civilization spreads. Beat the mosquito by cleanliness and common prudence, and the tropics become health resorts.

The mosquitoes are well known to all; but certain gnats and midges look very much like them. The mosquito's body is slim, slightly humpbacked; the legs are long and slender; the wings, when at rest, are folded over the back; the head is small and bears the complex lancet with which the female probes the skin of its victims to suck their blood. The male does not bite and his antennae are finely feathered.

What did the mosquitoes do for their blood supply before man appeared? They lived, we suppose, on vegetable juices. The deduction is based on the fact that mosquitoes deadly to man and animals teem in billions in great areas of the world where man has never yet established himself, and where big mammals have not gained a foothold. The mosquitoes must live on plant food.

Related to the mosquito are those long, brown-bodied flies with straggling limbs, that we call crane flies. They look like mosquitoes as we might see a mosquito under a magnifying lens, but they have none of the sawing and piercing implements of the smaller and more formidable insect. Their mouth parts are framed only for the harmless occupation of sucking up surface moisture. The adult crane flies are harmless, though the spear-like projection at the rear of the female's body looks like a sting. It is, in fact, only a marvelous contrivance with which she bores, and through which descend the eggs she deposits in the ground.

The mosquito larva is hatched in water and is harmless there; but the crane fly is hatched in the earth, in the lawns, the pastures, the flower borders. And this does mischief enough to grass, the roots of flowering plants and so on, to make up for all the engaging helplessness of the swarming adults drifting in brown clouds in the air of a summer night. That we are plagued by these leatherjackets, as the larvae are called, is one of the penalties we pay for the indiscriminate slaughter of birds that hunt them.

Another relative of the mosquito is a small black fly whose eggs, laid in the earth, hatch out into the pest we call army worms. The maggots are about a quarter of an inch long. Normally, little groups keep to themselves, but in the years when numbers are enormous, swarms meet swarms. The innumerable larvae form themselves into long columns and march as an army. When one part of the line halts the others crawl above it, and the sinuous mass winds its slow length along, feeding, fattening, clearing all before it.

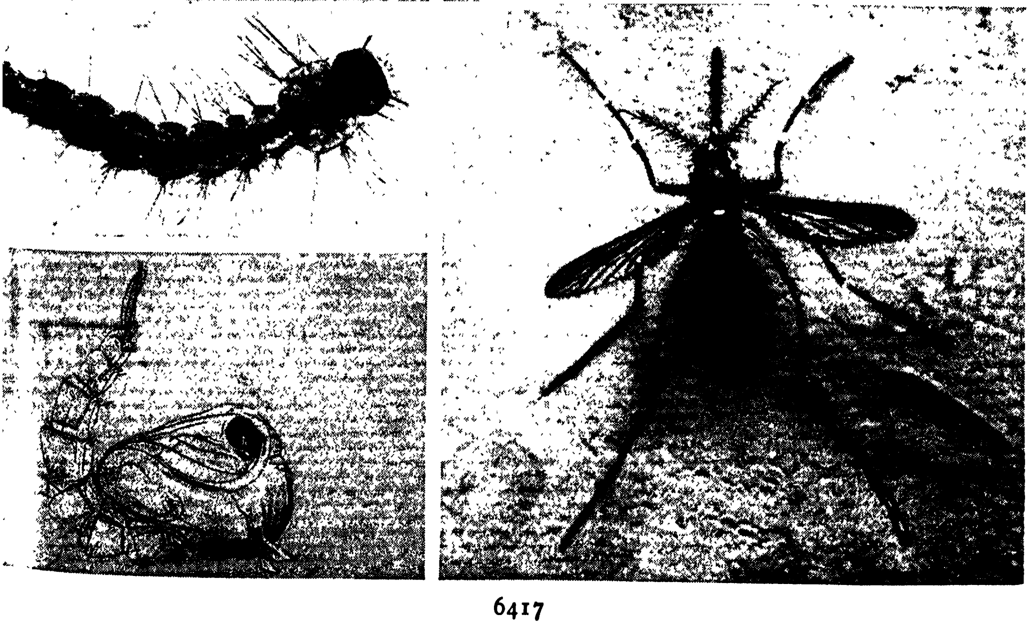
Perhaps because supplies grow short, perhaps because they have lived long enough in the larval form, the great mass contracts, thickens, becomes an enormous ball. Then it disappears slowly into the earth. Much mystery is made of this sinking into the ground, but there is no mystery. The army worms at the bottom of the pile excavate and sink the whole mass of life, as a burying beetle sinks the dead bird or mouse on which it intends to live. Though the name is applied to quite different larvae in different parts of the country, the habits of all are similar.

We now come to the midges. Their bite causes intense irritation, and genuine illness to some people who are susceptible to their not-very-terrible venom. We do not have to see the midges: a good ear catches the high note of their wings as they fly. Their bite is never fatal. It is inflicted by lancet and saw, after which a fluid is injected by the insect to render the blood thinner and capable of being drawn up.

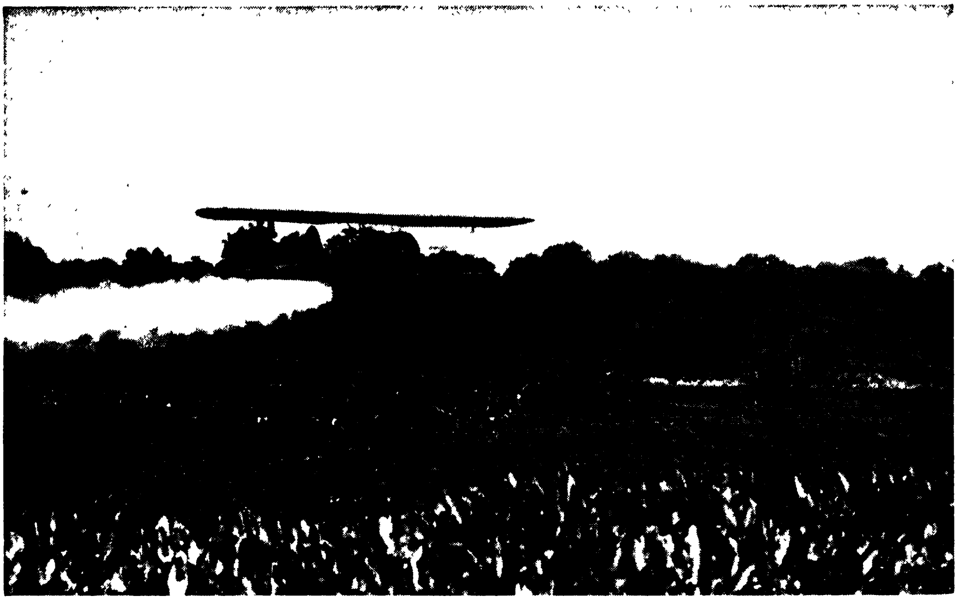
Midges, which are among the minor inflictions of summer life in the open, have their troubles not less grave than those they inflict. Enormous swarms of plumed midges have been observed in northern Asia to be apparently on fire with splendor, luminous and lovely. But this phosphorescent brilliance seems to be the product of harmful bacteria that so enfeeble the victim that it is reduced to crawling and is completely deprived of the power of flight. Some midges, however, in Europe, in New Zealand and elsewhere, can turn on a "cold light" without harm to themselves, as glowworms do. The larvae possess the radiance as well as their parents, and employ it as a lure to tempt prey to

Stages in the life of a yellow-fever mosquito: upper left, a larva; below, a pupa; right, adult female.

Three photos, U.S.D.A. Bureau of Entomology



DEATH ON MOSQUITOES!

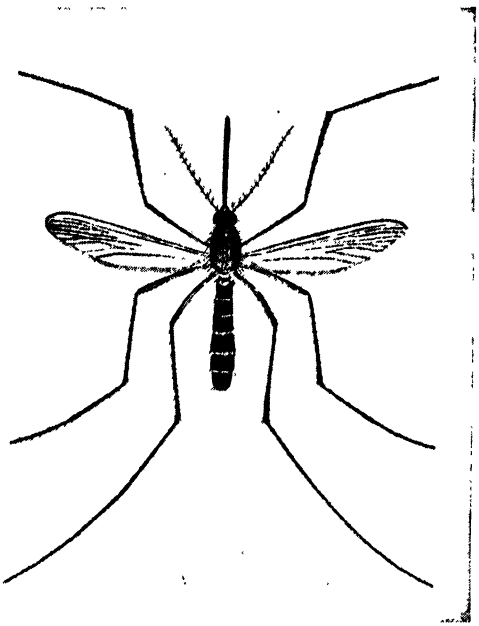


Acme

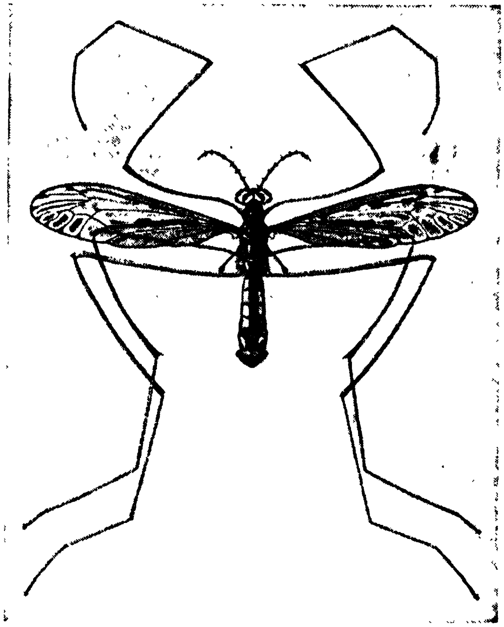
A plane sprays a swampy breeding area to kill the larvae of anopheles mosquitoes, which carry malaria. Using airplanes is the quickest way to spray a wide area, especially where it is a region of dense jungle growth.

Canadian Army photo

A gigantic "flit-gun" for northern woods. This vehicle, on caterpillar treads, is really a flame-thrower, of the kind designed for the second World War. For the war on mosquitoes, it fires a deadly mixture of DDT, kerosene and oil. The spraying is done before the insects have a chance to mature and leave the breeding-ground.



The buzzing pest of summer days near water—an adult female house mosquito with her sharp lancet.



An adult crane fly. The long, jointed legs give it the familiar and amusing name of daddy longlegs.

their doom in the larvae's gummy webs.

Compared with the mosquito, the housefly's body is heavy and compact; the antennae are short; the eyes are large and reddish; the legs are short; the mouth parts form a sort of pad or disc, well adapted to sucking moisture. Other species of flies, however, pierce the skin and suck the blood of animals and man.

There is not much mystery remaining for us in the life-story of the flies that haunt our homes, unless it be the mystery as to why we tolerate them. The flies that infest our homes are, most of them, born in refuse dumps and other dirty places.

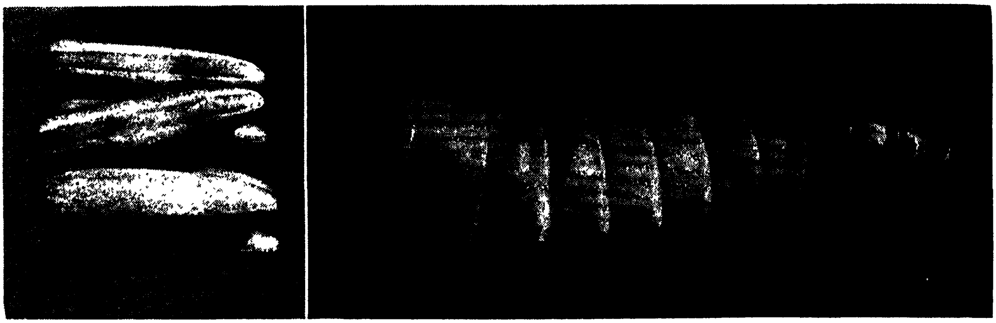
Egg, larva and pupa stage are all passed in these unclean surroundings. The fly bursts from its pupal case and has to crawl through filth to the daylight. Its feet and its hairy body bring with them crowds of deadly microbes. They come to the food and perhaps cause illness to babies and adults.

The housefly keeps the germs of typhoid alive in its body for twenty-eight days, and for another twenty-three days after this deadly parasite leaves the body of the insect it retains its life and virulence. In addition, the fly brings into our homes cholera, dysentery and other diseases.

We have more than one species of house-

Three photos, U.S.D.A. Bureau of Entomology

The long, cylindrical eggs of the house mosquito, laid together, look like a mass of tiny cartridges.



Photos, American Museum of Natural History; U.S.D.A. Bureau of Entomology

The brief life of a house fly: Left, eggs; above, a larva; page 6421, upper left, a pupa; upper right, adult emerging

fly. The majority merely moisten and suck; but the little black houseflies draw blood. These are not undersized members of the ordinary fly tribe, but fully developed examples of their kind; for flies are full-sized at birth and never grow after quitting the chrysalis form.

With ways less terrible to ourselves, but dreadful to animals, there are many flies that keep to the open air. Among these are various botflies. One of these, *Gastrophilus equi,* is a plague to horse life. Irritated by the attentions of the fly, the horse licks itself and transfers the larvae to its mouth, whence they are swallowed. The larvae hook themselves to the stomach or intestines of the horse and there complete their larval growth.

We do not know that the process does the horse very much harm, but it must cause discomfort. There is unfortunately less doubt as to the warble fly, which cattle fear as we fear angered hornets. In the blazing heat of a summer afternoon, when the cattle should be chewing cud in the shade of the trees, we sometimes see them madly rushing around the pasture. The cattle are clumsily seeking to flee from this enemy.

The fly deposits its eggs on the hide of the animal. There these hatch for the maggots to eat their way into the flesh and cause hideous wounds beneath the skin. As many as four hundred of these gnawing parasites have been found beneath the hide of a single cow. The poor animal is miserable; it loses flesh, and its milk becomes scanty and inferior. When the end comes, and its hide is to be converted into leather, immense damage is found to have been caused. The leather trade suffers from this cause a loss of millions of dollars a year, to say nothing of the sufferings that the unfortunate cattle have to endure.

The so-called sheep botfly penetrates the flesh of the sheeps' nose with disastrous effect. But the name of this fly is too restricted, for the insect attacks man, birds, frogs and toads, as well as sheep.

We have noted the love of cattle for shade, a passion that horses share; but there are winged enemies for them there too. There are several species of strange forest flies. They attack horses, cattle, deer, and even birds. Beginning as winged couriers, they break off their wings when they alight on their prey, just as queen ants break off theirs after the marriage flight. Then these flies settle down to drink blood drawn from those parts of the flesh least protected by hair.

There are more terrible forest flies than these, however—the tsetse flies, which haunt the forests deeply fringing the great waterways of Africa. There are many species of tsetse flies, some harmful to domestic animals and not to man, others terrible to humans.

These flies are parasitic on the great game of the Dark Continent and they are able to take their blood supply from animals with tough hides, such as antelopes and zebras. They are furnished with piercing and sucking implements.

Now, in the blood of the game that these flies attack swarm myriads of low organisms, eel-like in outline, called trypanosomes. They undergo one stage of their growth in the original host, and are then sucked up in the blood drawn by the fly. They remain dormant in the insect and renew growth and attain maturity in the body of the mammal that the tsetse next bites.

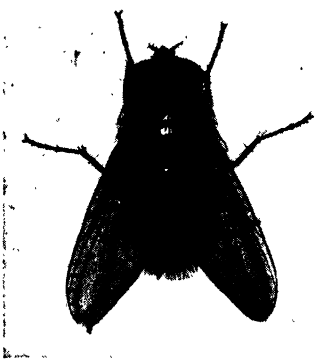
The range of the tsetses is widespread, but not continuous. They abound in what are known as fly belts, areas of great size into which no domestic animal can penetrate and live. The fly injects its poisonous parasites into horse, ox, donkey, dog, and these

and Standard Oil Co. (N. J.) photo by Parks
from the pupa case; bottom, adults on human food.

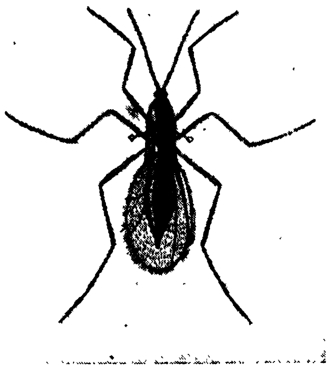
sicken and die. That disease, peculiar to animals, is called nagana, and can not develop in human blood. That is a hindrance to colonization in the fly-infested country, for man is still dependent on animal service.

But it is from another tsetse fly that sleeping-sickness is carried to men. This disease is as fatal to white men as nagana is to white men's animals. Natives whose ancestry has for generations lived among tsetse flies are as immune as zebras and lions are to nagana. When new areas are opened up between tsetse country and non-tsetse country the flies advance through the cleared ways and produce havoc among the non-immune natives. Possibly no malady has run through Africa with such rapidity as sleeping-sickness.

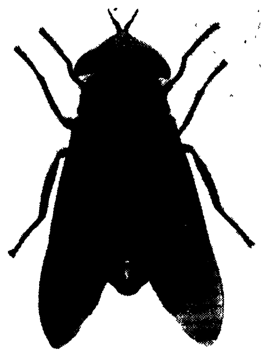
Flies of many species have yet to be studied, and there are a host already described for the student who can seek their story in science textbooks; but we may repeat that not all the flies among us are harmful. The bee flies are a boon to us. The adults restrict themselves to the nectar of flowers, which they help to fertilize, but their larvae are great devourers of caterpillars and of ground insects that harm our crops. The drone fly's larvae eat decaying vegetation that makes wayside waters unpleasant, and also consume carrion when the eggs are laid in the carcass of a dead animal.



A blowfly, which deposits its eggs on meat, where they develop into larvae, or maggots.



An adult Hessian fly, or midge. Its bite is usually more annoying than really harmful.



A black horsefly, sometimes called a gadfly. The females suck the blood of animals.

Photos, U.S.D.A. Bureau of Entomology

The bumblebee flies closely resemble the bees after which they are named, but they puzzle us. Some place their eggs in the nests of honeybees, some in those of wasps. It is not certain whether the larvae eat the young of the bees and wasps or whether they merely act as scavengers and consume waste matter. The second idea of the larvae's food habits seems the more probable.

We are on more certain ground with the hover flies, and can welcome them with delight. As they dart and dash among our sunlit flowers, first with the speed of a dragon fly, then pulling up short as though halted by the most marvelous of brakes, then rising straight on a level keel, next darting sideways, then backward, then down, fast as the sunbeam they follow, we see the perfection of flight, the ideal at which man aims, but has not yet attained.

We welcome the hover flies as allies, for their larvae grow up among the plant lice, and devour the vital juices of those parasites with an appetite like that of a hungry donkey introduced to unlimited carrots. There is in northern Africa a fly, the *Idia fasciata*, that is worth far more than its weight in gold. It eats the locust's eggs.

The parent fly has no direct part in the service, except a wonderful instinct for finding where the eggs lie. She is even more determined than the ichneumon, which pierces a tree to lay her eggs, for this little fly burrows down three or more inches into the hard soil to reach the place where the great powerful locust has hidden its store of eggs.

There the *Idia fasciata* lays ***her*** eggs, and the young ones, when hatched, live entirely on the locust eggs, which they devour in great quantities. How much they save us by this destruction of the foes of the crops is not to be estimated, but man's debt to them must be very great.

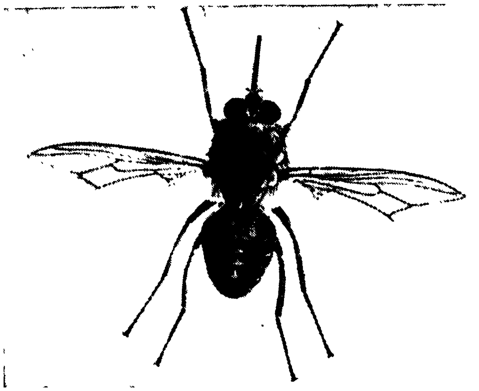
There are flies peculiar to celery, to carrots, to onions, to apples, and so forth, all laying eggs from which maggots emerge to devour either the foliage, the fruit or the root of the growth to which their lives are committed.

The number of pests tends to increase, as does the number of individuals, where neglect makes multiplication easy. There is a treatment for each if we will take the trouble to apply it. A few cents may bring to any of us admirable publications prepared by the greatest living experts under the direction of the Department of Agriculture. It is our own fault if we do not meet these scourges of the fields, pastures and garden with the knowledge that may make us triumphant. Human population is constantly growing; indeed it is slowly outgrowing food supplies, so we shall in time have to fight the insects scientifically or starve. In fact, the battle has begun.

Both photos, American Museum of Natural History

Horses and sheep have reason to fear the botfly. The larvae of one species grow in the digestive organs of horses; others attack the noses of sheep.

A tsetse fly, probably the most harmful insect in all Africa. One kind spreads the dreaded sleeping-sickness; and another sickens livestock.



The flies are marvelous in their methods of maintaining a hold on life and of extending their sphere. There are flies that do not depend on reproducing separate generations by successive batches of eggs. Some are born alive, devouring the body of their mother before entering the world as larvae ready immediately to turn into chrysalises. More wonderful, we have baby flies giving birth to other baby flies. That is to say, the larvae without ever attaining perfect insect form, produce larvae like themselves. The new generation of larvae devour the old larvae of which they are born, and they themselves, remaining babies, become parents, for they also, without growing up, evolve other larvae from their own bodies.

Fleas were formerly classed with flies, and were described as flies that had lost their wings. They are now generally treated as a separate order. However, in caves and underground watercourses, flies have been found that have lost their wings as completely as the fleas.

There are at least a hundred known species of fleas, of which a third are found in America. Fortunately the ordinary house flea of Europe *(Pulex irritans)*, which prefers to bite human beings, is not common on this continent; but those that live on our cats and dogs are unpleasant enough. Many of our animals—squirrels, foxes, rats—have special fleas of their own, which may sometimes bite humans though usually without harmful effects.

At least four species of fleas that are common on rats are known to bite man. Now, the rat may be infected with that dreadful disease common in Eastern countries known as bubonic plague. It is probable that this disease, or something very much like it, was the plague, or Black Death, so common in Europe during the Middle Ages. A sick rat may board a ship in an Eastern port, bringing his fleas with him, and may leave the ship in one of our ports. When a plague-stricken rat dies, its fleas may leap on a human being and bite him, and he dies of the plague.

Happily our ports are so well guarded against rats that there is little likelihood of plague's gaining a firm foothold nowadays. However, a few cases have appeared from time to time in some cities of the United States.

THE NEXT STORY OF ANIMAL LIFE IS ON PAGE 6523.

Can a Fly Hear?

THE more we study the senses of different animals, the more do we learn that the sense of hearing ranks high in the scale, and comes late in the history of the progress of life; and thus we find that various creatures, whose powers of touch and of smell and of vision are marvelous, seem to be almost, or entirely, deaf.

There are a few insects that can hear, but the greater number, including flies, can not hear at all. Every imaginable kind of sound has been tried, and insects, with the exception of very few, take no notice.

The highest string of a violin has been scraped an inch away from bees engaged in pillaging flowers, and they paid no attention. The senses of insects, including flies, are so wonderful, and in some respects so superior to our own, that it is immensely interesting to find that nearly all, including the highest insects, such as the bees, ants and wasps, are deaf.

IS A FLY STRONGER THAN A MAN, IN PROPORTION TO ITS SIZE?

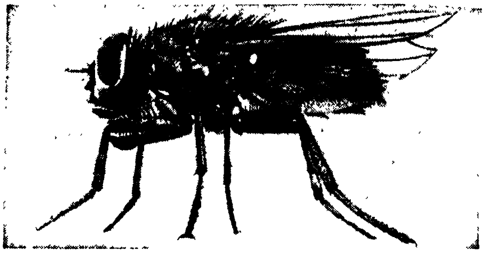
The answer is certainly yes. The last thing in the world that distinguishes man is bodily strength of the kind that is shown in lifting weights, and so forth. It is by *skill,* made not by the muscles but by the brain, that man triumphs on the earth—skill, not strength.

Not only flies, but animals in general, are the superiors of man so far as muscular strength is concerned.

CAN A FLY SEE IN ALL DIRECTIONS AT THE SAME TIME?

A fly can not see in all directions at once, because, whatever the shape of its eyes, one part of them, at any rate, must lie against the fly's head, and in that direction, at least, the fly can not see. But it is true that the eyes of flies, and of many other insects, can see in far more directions at once than ours can. This is especially the case where the eyes are very rounded and bulging.

We must not suppose that this means clear vision at the same time in all directions; but it does mean that, while looking in one direction, the insect can get a hint of movement much farther round the corner than we can. The proper way of saying this is that their field of vision is very large, even though it does not quite amount to seeing "all ways at once."



American Museum of Natural History

The eye of the fly is made somewhat like a precious stone that has been cut into many little faces, or facets. The number of these tiny facets on the eyes of insects is extraordinary. A male ant, for instance, may have twelve hundred facets on each eye, and the number on the eye of the dragon fly has been reckoned as high as seventeen thousand. Eyes made in faces, or facets, are called compound eyes.

WHERE DO ALL THE FLIES GO IN THE WINTER?

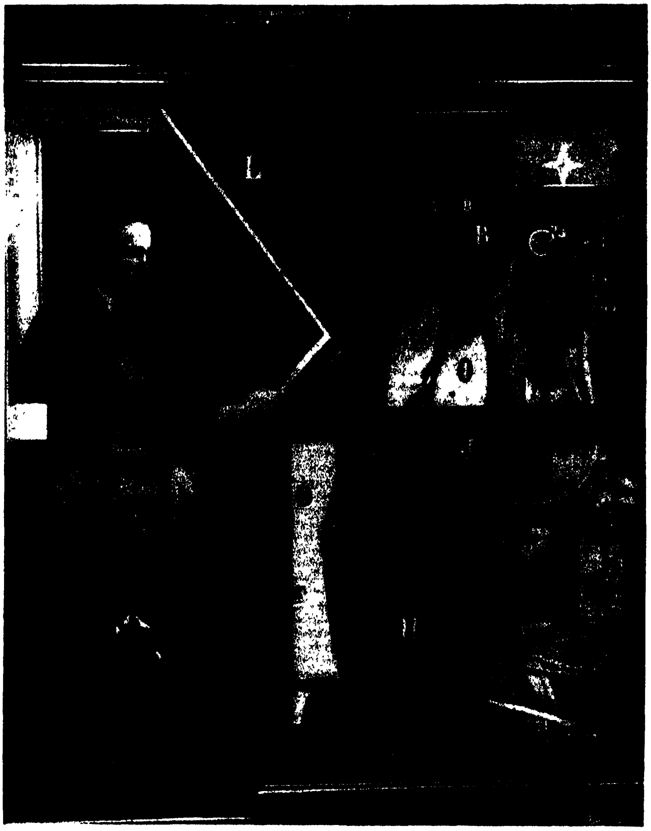
Most flies live their lives in spring and summer; then die. Some of them are fortunate enough to find a place where they can hide and obtain warmth.

They hide in quiet places about the house, in outbuildings, in the fields and stables. They do not feed. They simply lie dormant, sleeping as a squirrel in his nest, or a bear in his den, or a tortoise in his shell sleeps the cold days away.

But an unexpected warm day in winter comes. The fly feels the extra warmth. It wakes him, makes him hungry, and sends him forth to seek food. The warm day passes, and he may get back to safe hiding; but most likely he will not. Probably the cold will return and kill him. Very few flies manage to get through the winter. If they are not worn out and ready to die at the end of the summer, many of them are killed by a fungus that, floating in the air, settles on their bodies, drives roots into their insides and destroys them. Those we see dead on the windowpane have been killed in this way. Those that live through the winter lay eggs, and soon there are as many flies as ever. Killing one fly in the spring means many fewer in the summer.

THE NEXT WONDER QUESTIONS ARE ON PAGE 6532.

HOW YOU CAN TAKE YOUR OWN PICTURE



(A) Roll of Sensitized Paper
(B) Governor Controlling Operation of Lens, Shutter and Feeding of Paper
(C) Lens and Shutter
(D) Coin Operating Mechanism
(E) Switch Controlling Magnets, Coin Slot Locking, Pilot Light and Paper Cut-off Device
(F) Paper Cut-off Mechanism
(G) Motor Controlling Drive for Governor, Developing Tank and Dryer
(H) Relay Panel and Fuse Box
(J) Developing Tank
(K) Replenishing Tank
(L) Overhead Flood Lights
(M) Water Inlet for Washing Pictures
(N) Cooling Tube from Refrigerator Unit
(O) Drying Unit
(P) Picture Delivery Chute

The inventor's right hand, in this picture, is over the slot for the coin.

THE photomaton operates on the principle of a vending machine. You sit in a booth facing the lens and drop a coin into a slot. When the coin is deposited it makes an electrical contact which turns on the flood lights and starts the machine going. The shutter of the lens opens and closes eight times with a few seconds' interval which permits the sitter to change pose or facial expression. The exposures are made directly on the sensitized paper which is carried on a belt past the lens. The paper is then carried down into the developer, through other chemicals, and water, into an electric dryer. By use of a special chemical process, the exposures are developed as positives instead of negatives. The strip of eight finished sepia photographs is immediately and automatically delivered. The entire process takes eight minutes. Our illustration shows the inventor, Anatol Josepho, a young Russian, at the machine. The strips of eight portraits show the type and variety of photographs taken by the photomaton. The field for its use, aside from personal souvenirs, is wide—passports, licenses, identification cards, commutation tickets, etc.—and the cost low.

VOLUME XVIII

The Book of Knowledge

The Children's Encyclopedia

THAT LEADS TO LOVE OF LEARNING

Editor-in-Chief
E. V. McLOUGHLIN, L.H.D.

Educational Consultant
LEONARD POWER, Ed.D.

With an Introduction by
ALEXANDER J. STODDARD, Ed.D., L.H.D., LL.D.

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The

BOOK OF KNOWLEDGE

The Children's Encyclopedia

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U. S. Forest Service

Huge flocks of sheep like this one are a common sight in parts of Montana and Wyoming. These sheep are being brought down from the Beaverhead National Forest in Montana, where they have had their summer range.

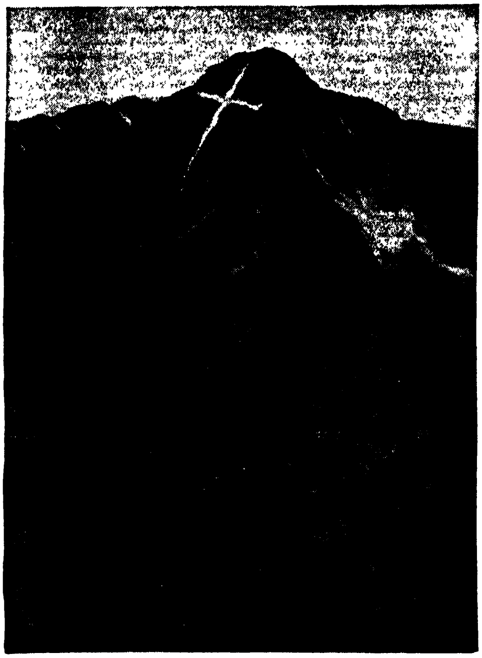
THE WESTERN STATES—PART I

A FEW hundred miles west of the Mississippi River, from the Canadian border on the north to the Mexican border on the south, stretch the great plains of the central United States. North and South Dakota, Nebraska, Kansas, and parts of Oklahoma and Texas lie within the limits of this vast plateau. We think of this country as being quite level, but it is really a long, gradual slope, rising to the foothills of the Rocky Mountains on the west. Between the 100th meridian, which, on the maps, runs down the middle of the plains, and the Pacific Ocean, are the eleven states which we call the western states. They are Montana, Wyoming, Colorado, New Mexico, Idaho, Utah, Arizona, Nevada, Washington, Oregon and California.

This part of the United States is a real wonderland. Everything in it seems to be on a grander scale than anything the East can show. The highest mountains, the deepest valleys, the biggest trees are here in the West. The region has mountain meadows carpeted with wild flowers; burning alkali deserts; geysers that shoot boiling water many feet into the air, and even a real live volcano—Lassen Peak, in California.

All of these are Nature's gifts to the West, but man has created wonders there too. His railroads and highways thread the narrow gorges of rushing rivers and burrow under the high mountains. He has built enormous dams and created big lakes from which water is carried to irrigate hundreds of square miles of dry, but otherwise fertile, land. These gigantic water works also furnish electricity to light the farms and cities and to turn the wheels of industry.

Long before the English settlers came to America the king of Spain considered the country to the west of the Mississippi a part of his empire, but neither he nor anyone else at that time knew how vast this territory was. A few fearless Spanish explorers wandered over the country, chiefly in what is now Texas, New Mexico and Colorado. Others sailed along the Pacific coast and sent parties into what is now California. These



Denver Conventions and Tourist Bureau
The Mount of the Holy Cross in western Colorado gets its name from snow-formation on its peak.

adventurers returned to their strongholds in Mexico and Spain with but hazy ideas of the country they had explored. The maps which they drew look like quaint and curious pictures to American school children of today.

As early as the 1540's Spanish missionary priests came to New Mexico and Arizona, and by the year 1800 the Franciscans had established eighteen missions in the present state of California. The Spanish missionaries and explorers did not penetrate very far north in this huge country. It was the French explorers and fur traders, and later the British and Americans, who made their way into the Northwest. Neither the Spanish nor the French nor the British did much in the way of settlement.

Some of the present West became a part of our country in 1803, when President Jefferson made the Louisiana Purchase from France. Even then few people realized what a big piece of real estate was changing owners. The price was $15,000,000. Napoleon seems to have sensed the importance of the deal. He said: "A magnificent bargain—an empire for a trifle—the day may come when the cession of Louisiana to the United States shall render the American people too powerful for Europe." President Jefferson said that the land was a barren waste and that he bought it mainly to have control of the Mississippi River.

Courtesy, Denver and Rio Grande Western R. R.
A service station on top of Pike's Peak, Colorado.

In order to find out how big the land was and what its resources were, Jefferson sent Meriwether Lewis and William Clark on an expedition to the Pacific in 1804. Fur traders and Indian guides led them up the Missouri River to the Rocky Mountains across passes to the Columbia River, and down the Columbia to the Pacific. They were gone for more than two years. When they returned they brought with them an immense amount of information about the Northwest. The Lewis and Clark expedition did much to interest Americans in the western half of the continent, but many more years passed and many stirring events took place before the great westward movement of the population really began. You may read about these things in the chapter The Growing West.

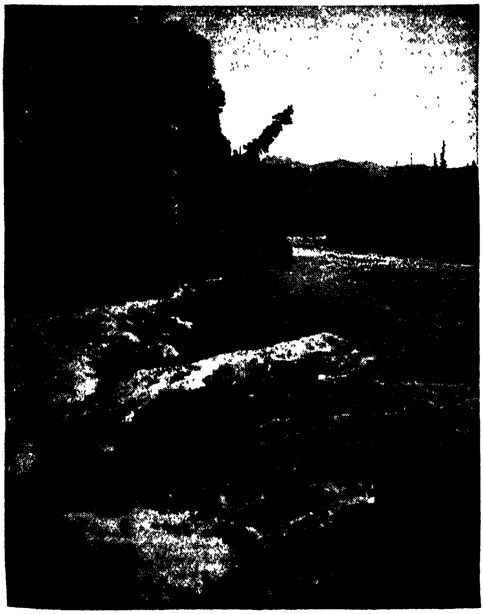
In telling about these western states we shall begin with the group that we call the Rocky Mountain states, Montana, Wyoming, Colorado and New Mexico. This great mountain range runs down the western half of these states, but their eastern part is flat. The Great Plains slope up to a height of almost a mile above the level of the sea in eastern Colorado and Montana. The land becomes drier and drier, until near the mountains there is hardly enough moisture to grow crops. Crops are raised in the Great Plains either by irrigation or by dry farming.

It would be a mistake to think of the Rocky Mountains as one great wall of rugged country. On the contrary, there are many places where the plains extend into the mountains, much as the ocean sweeps into great bays along a seacoast. In central Wyoming there is a break in the mountains made by one of these great seas of plains. Some ranges of the Rockies stretch out into the plains as peninsulas do into the ocean. Such, for example, is the character of the Big Horn range in Wyoming. Inclosed within this arm of the mountains is the Big Horn Basin, where people have discovered oil in the rock beneath the surface, and where much land is irrigated. There are many other places along the edge of the mountains where derricks tell of the presence of oil wells.

Within the mountains there are many wide valleys which are favored locations for small towns. In Montana there is the great valley called the Rocky Mountain Trench, and in Colorado there is a series of "parks" called North, Middle and South parks. These are natural park lands, and should not be confused with the national parks.

Mining towns are numerous in the Rockies. This whole region is thickly underlaid with such metals as gold, silver, copper, zinc, lead and many other, rarer minerals. Leadville, Colorado, is the highest town in our country —over 10,000 feet above the level of the sea. It is located near mines that are rich in gold, silver and lead. There are many ruins of mining towns in the mountains, too, ghost towns abandoned because the ore finally gave out. There are also many holes in the ground where there have never been any villages. These tell their story of prospectors searching in vain for the precious metals, and finally giving up the search. Some of the mining camps grew up in a few weeks and lasted not much longer. When the metal is gone there is nothing to keep people in these mountain villages. At the same time, some mining cities, such as Butte and Anaconda, in Montana, and Bisbee in Arizona, have thrived.

Butte and Anaconda are copper-mining towns, situated in the midst of the richest copper-mining section in the world. Butte is the home of the Montana State School of Mines, one of the leading institutions of its kind in the world. Anaconda is where the copper and zinc from the Butte mines is taken to be smelted, or purified. Another Montana city which is connected with the mining industry is Great Falls on the Missouri River. Here a big hydroelectric development furnishes power for refining copper and zinc and lead. Great Falls is not, however, entirely dependent upon the produce of the mines. It is a center for agriculture and trade as well. Helena, the capital of Montana, is



Swift, rushing rivers flow through the mountains of Idaho. This is Cabinet Gorge, near the Montana border.

The curious rock formation near Casper, Wyoming, which is known as the Teapot Rock.

Idaho State Chamber of Commerce

largely occupied with politics, but it is also the center of a cattle and sheep raising district, with some gold mining. Missoula, on the Pacific slope of the Continental Divide, is the center of a rich farming district and *the home of Montana State University. Billings, in Yellowstone County, is surrounded* by a dairying country, and is also a center for sugar-beet farming. In some parts of Montana fruits are grown, and in others, potatoes and wheat are the leading products. So we see that Montana has a rich and varied produce, and is not entirely dependent upon its mines.

Wyoming, with its vast plains, snow-capped peaks and fertile valleys, is still, more than any other state, the land of the cowboy. The rodeo is the favorite type of celebration, and everywhere the tourist goes he is reminded of the exciting days of the western frontier. Nevertheless, about two-thirds of the people of the state live, not on farms or ranches, but in the towns and cities. Not one of these cities is over 25,000 population, and all of them are attractive and interesting places to visit.

Cheyenne, the largest city and the capital of the state, is famous for its yearly Frontier Days' Festival. It is also known as an important railway and air-line center, but to people all over the world who like stories of the Old West, it will always suggest the romance of the cattle trails and the open range. Casper, on the North Platte River, is also a center of air and rail transportation, and has important oil refineries. Sheridan, near the Big Horn Mountains, and Laramie, the seat of the University of Wyoming, also share the magic of the traditions of a more colorful era in the state's history. Beside the cattle industry, and the dude ranching which is almost as widespread, Wyoming produces on irrigated land such crops as wheat, alfalfa, sugar-beets, potatoes and fruit. Millions of sheep graze on its slopes and furnish a valuable wool clip each year. It has a mineral wealth that has as yet hardly been touched, and its natural wonders and wild life have made it a paradise for hunters and lovers of the oudoors.

You may read about Yellowstone National Park and Grand Teton National Park in other parts of your BOOK OF KNOWLEDGE. Another of the state's wonders is the largest hot spring in the world, at Thermopolis.

The Rocky Mountains are in most places

Union Pacific Railroad photo

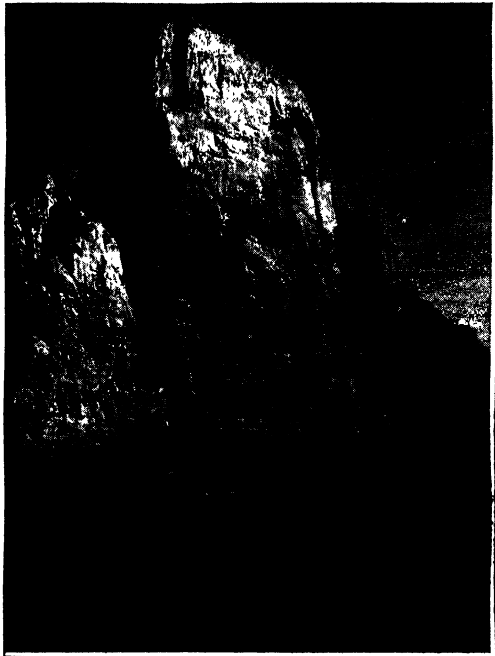
The corral of a dude ranch in the Jackson Hole country in Wyoming. Dude ranches are extremely popular vacation places for people who like an outdoor life with plenty of riding and other attractions of the range.

NATURE'S WONDERLAND OF THE WEST

Rainbow Bridge in southern Utah. Wind and sand and water have carved the rock into a natural arch.

The Great White Throne in Zion National Park, Utah, towers above the almost flat land at its base.

U. S. National Park Service



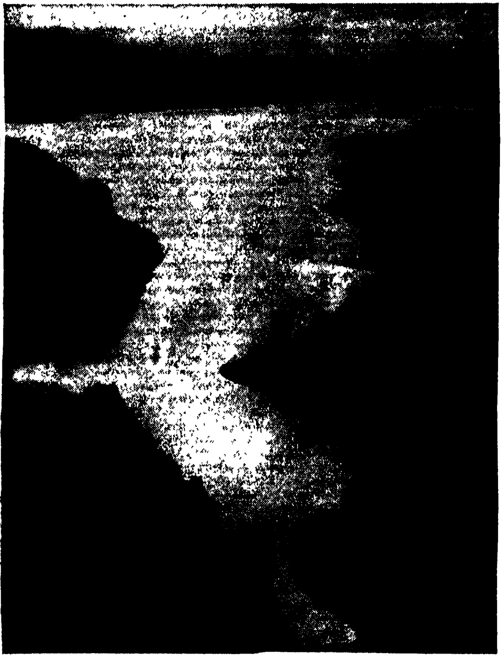


Photo by Lucier, Powell Wyoming

The Shoshone dam and reservoir in Wyoming. Along its rim is the Cody highway to Yellowstone Park.

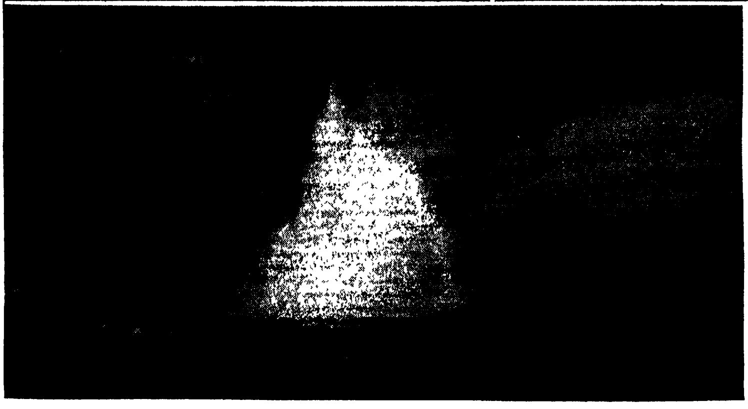
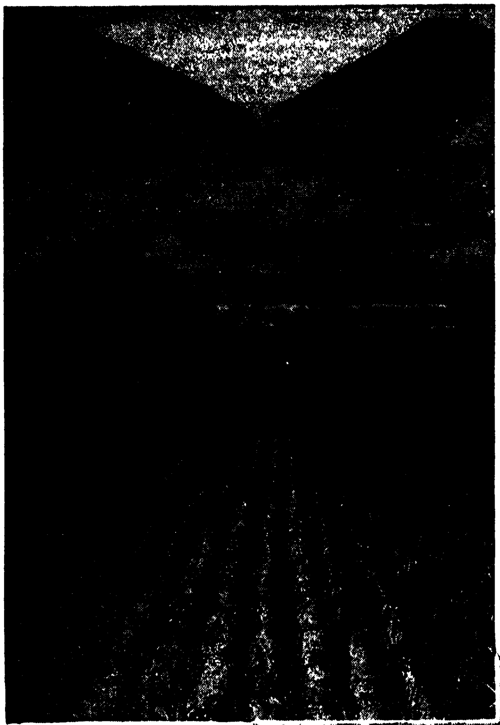


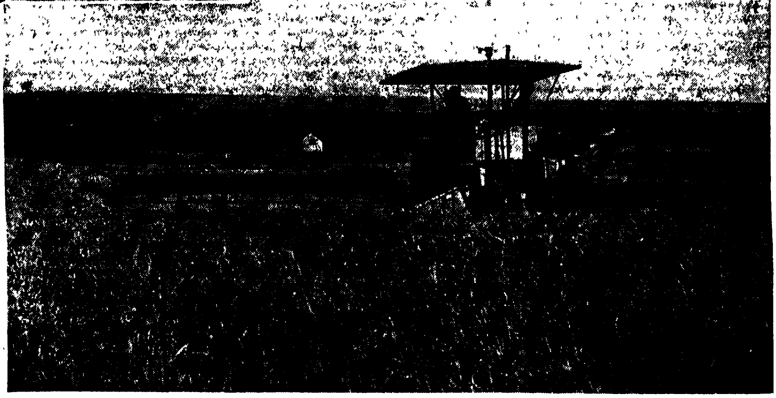
Photo by J. E. Haynes, St. Paul

The Fountain Geyser in Yellowstone Park is seldom in eruption. Note the dense clouds of steam.



Salt Lake Chamber of Commerce

A truck farm in Davis County, Utah. Fine vegetables are grown in Utah. Celery is one of the specialties for which it is famous.



Washington State Progress Commission

Harvesting some of the 60,000,000 bushels of wheat produced each year in the part of Washington that is east of the ranges of the Cascade Mountains.

covered with trees up to the timber line, and many of these forests are owned by the United States Government. Wyoming has six of these national forests entirely within the state's boundaries, and parts of several others are within the state. In Colorado, to the south of Wyoming, there are fourteen of these forest preserves.

Like Montana and Wyoming, Colorado is famous for its wild life and for the healthful outdoor recreation it can offer the tourist. Denver, the capital of the state and the largest city in the Rocky Mountain group, lies where the mountains and the plains meet. To this city and to its near neighbor, Colorado Springs, thousands of visitors come every year. Denver is also a center for trade and manufacturing, and during World War II actually entered the shipbuilding industry, although the city is twelve hundred miles from the sea. All of the parts for the ships were built by different manufacturing firms in Denver, loaded on freight cars and sent by rail to San Francisco, where they were put together and launched. Colorado Springs is a famous health resort and it has long been an art center. During the war its steel-and-concrete art museum, one of the finest in the country, was selected as a place of safekeeping for more than a million dollars' worth of wonderful paintings from eastern museums.

Not far from Denver is Rocky Mountain National Park, through which runs the Continental Divide—the ridge which separates the streams which flow toward the Atlantic and those which flow toward the Pacific. One of these streams, the Arkansas River, has provided us with a striking example of the wonder of Nature and the skill and determination of man. In Frémont County, Colorado, the river flows through the Royal Gorge, between straight red granite walls more than a thousand feet high. Across this gorge has been built a suspension bridge, the floor of which is 1,053 feet above the stream. Far below, along the bottom of the gorge, runs the main line of the Denver, Rio Grande and Western Railroad. When this railroad was built there was so little space between the river and the cliffs that men had to be suspended by ropes from the cliff tops to drill the first blasting holes.

We have spoken of dry farming and of

WHERE IRRIGATION BRINGS RICH RETURNS

Southern Pacific Railroad

In the Santa Clara Valley of California are miles of prune orchards. In blossom time they make a lovely sight.

© Asahel Curtis

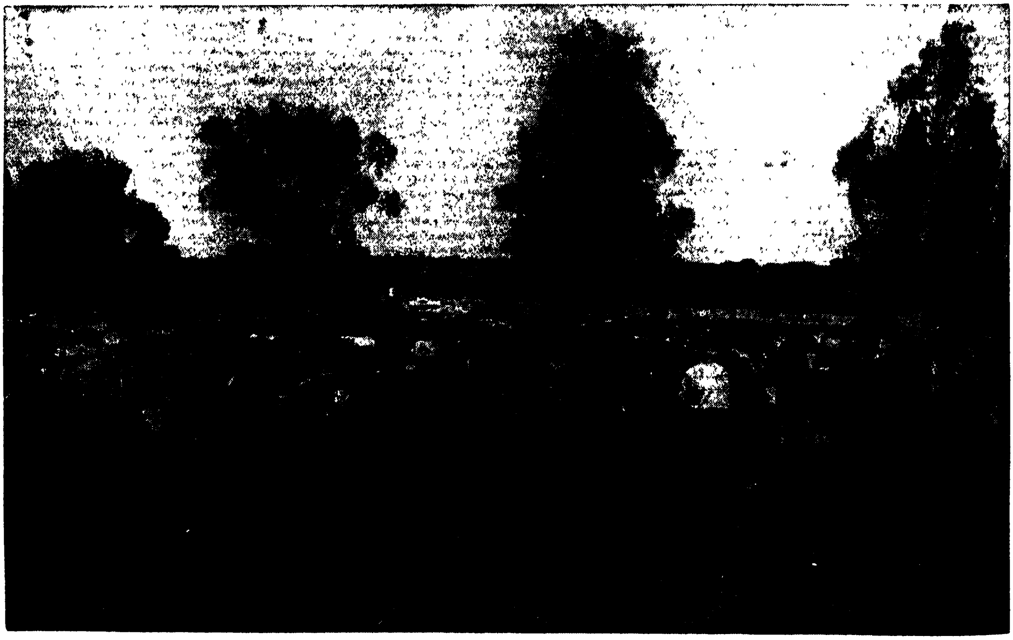
The Wenatchee Valley in the State of Washington is one of those areas which have extremely rich soil but are lacking in water. With modern methods of irrigation such regions are richly productive.

irrigation, two methods of farming which are used in the dry parts of many of the western states. We tell about methods of irrigation in another part of THE BOOK OF KNOWLEDGE. Colorado has the distinction of having one of the oldest irrigation projects in the United States, in the country around Greeley. The first settlers in Greeley came there from New England in 1871. They were the first people in this country to irrigate the higher lands along the river rather than the lowlands. Within recent years the building of great dams and storage reservoirs throughout the West has brought about a wonderful increase in the amount of land under irrigation. Much of this dry land is extremely fertile, and all that it needs is water.

Sometimes it is not possible to provide irrigation over large areas of farm land, and in such cases a method is used called dry farming. The dry farmer has to work very hard to raise crops, for he has to make the most of what natural rainfall there is. He does not plant each field every year. Half of his fields are plowed and harrowed but are not planted with seed. This is called summer fallowing. When the rain falls on these fallow fields, the soil that has been loosened by plowing soaks up much more of the water. Then, too, the stirring up of the soil helps to keep the water from evaporating. In the following year, the farmer plants a crop in these fields and the plants have the benefit of two years' rain rather than that of only one year. The dry farmer grows crops whose natural homes are in dry lands. A grain called kaffir and a grass called sudan grass, both from dry climates in Africa, are examples of this kind of choice.

Both dry farming and irrigation are used in New Mexico, the southernmost of the Rocky Mountain states. Dry farming is carried on chiefly in the northeastern part of the state. Irrigation methods are used in the valleys of the Rio Grande, Pecos, Gila and San Juan and other rivers. The big dams and reservoirs, such as Elephant Butte on the Rio Grande, and Alamogordo, Avalon and McMillan on the Pecos River, provide water for large areas; but even the smallest streams are put to use by the farmers and ranchers.

Agriculture is the chief industry of New Mexico. Grains, potatoes, sugar-beets, cotton and fruits are raised, besides cattle and sheep. Mining also is important. Gold, silver and copper, lead, zinc, turquoise and even a little platinum are found in New Mexico's mountains. Natural gas and petroleum are produced in several parts of the state, especially at Hobbs, near the Texas border, in the southeast corner of the state.



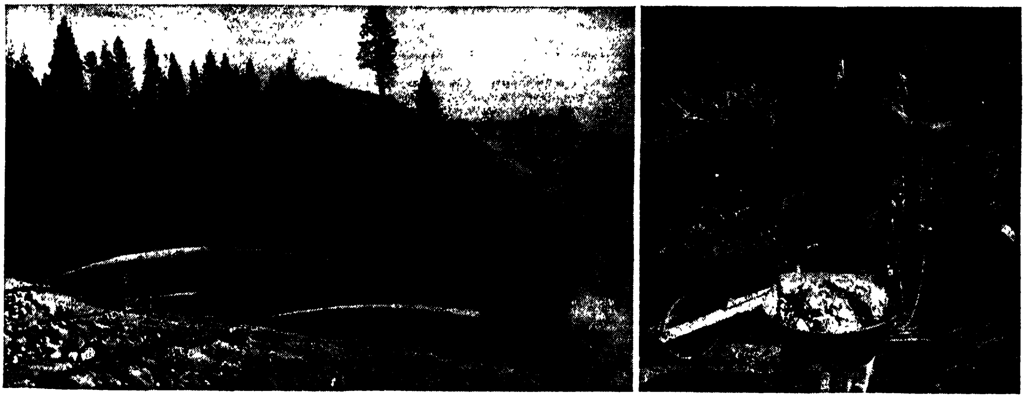
Southern Pacific Photo

A scene on a New Mexico cattle ranch. The romantic days of the cattle industry are passing, along with the unfenced range, cattle rustlers and Texas longhorns, but ranch life still has vigor and freedom.

TREASURE FROM THE ROCKS

U. S. Forest Service

The molybdenum mine at Climax, Colorado. Molybdenum is used in making certain special kinds of steel.

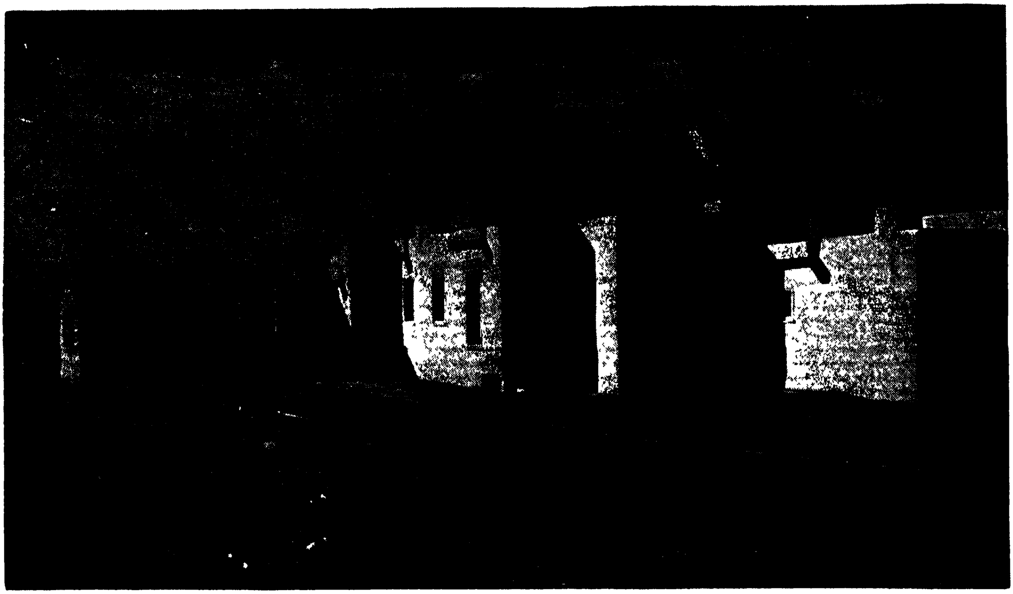


U. S. Forest Service

Two kinds of gold mining. Left; great jets of water tear away the rocks. Right; raising the ore from a shaft.

Above; an early gold mine settlement at Chinese, California. Left; the Great Falls reduction plant of the Anaconda copper mining company. In the foreground is the Black Eagle dam and power plant which supplies the power for reducing the ore.

Great Falls Chamber of Commerce



U. S. Indian Service

The day school maintained by the Federal government for the Indian children of Isleta Pueblo in New Mexico.

Tourists and visitors flock to New Mexico at all times and seasons, but particularly in the winter and the spring. It is a golden land under turquoise skies that are rarely clouded. The scenery ranges from lofty mountain peaks to winding river valleys and level desert lands. There are many natural wonders, such as the marvelous Carlsbad Caverns, the White Sands near Alamogordo, and Inscription Rock, on which the seventeenth-century Spanish explorers carved their names. One of the unusual and fascinating sights in New Mexico is the Aztec National Monument, a group of prehistoric dwellings. There are also a number of Pueblo Indian villages of the same kind in which the Pueblo Indians still live. They are rather like primitive apartment houses, each pueblo being a single building with many rooms.

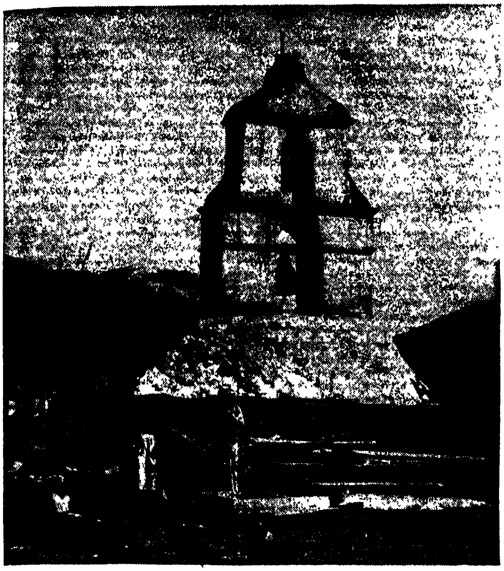
New Mexico has few large cities. Santa Fe, the capital, is the second oldest city in the United States, and it has been a capital for more than three hundred years. Albuquerque, the largest city (35,449), is the chief commercial and industrial city. Taos, with its Indian farming center, its pueblo and its ancient Spanish village, has become famous in the world of art and literature because of the celebrated painters and writers who have lived and worked there.

New Mexico has one distinction that it shares with only three other places: Hiroshima, Nagasaki and Bikini. It has been hit by an atomic bomb. On July 16, 1945, the first test of an atomic bomb was made in the New Mexican desert.

Let us turn northward again to where, bounded on the north by Canada and Montana and on the west by Washington and Oregon, lies the curiously shaped state of Idaho. It is a mountainous state, with many ranges, including the Bitter Root, Coeur d'Alene, Sawtooth, Blackfoot, Lost Rivers and Snake River mountains. It is a wild wonderland, with great forests, rushing, winding rivers and tremendous waterfalls, such as Twin Falls, and Shoshone Falls, which is higher than Niagara. The forests and rivers are full of wild game and fish, and thousands of hunters and fishermen visit the state during the season. The state has enormous mineral deposits, including gold and silver, lead and copper, and many other minerals which have scarcely been touched. Farming is important, and will become more so when all of the irrigation projects have been put into full operation. At present grains, peas, beans, sugar-beets, prunes and apples, and the famous Idaho potatoes are the principal crops.

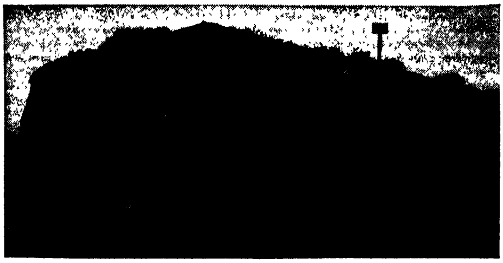
Idaho has no very large cities, but it has a number of pleasant and beautifully situated small cities, such as Boise, the capital, Coeur d'Alene, Pocatello and Idaho Falls.

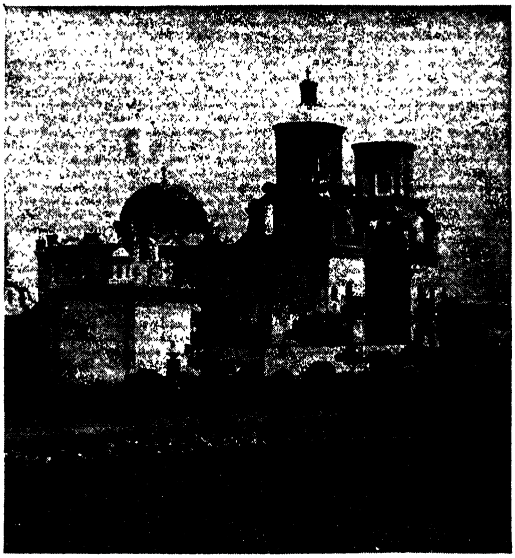
West of St. Anthony, in the eastern part of the state, is one of the most amazing sights



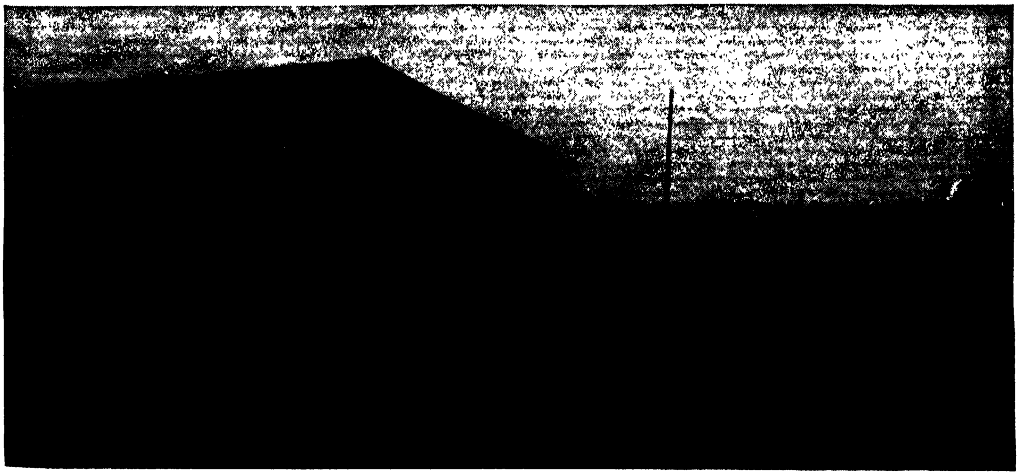
Putnam Studios
The ruined chapel of Pala Mission, near Los Angeles.

Ewing Galloway
The ancient Indian ruins of Casa Grande, in Arizona.

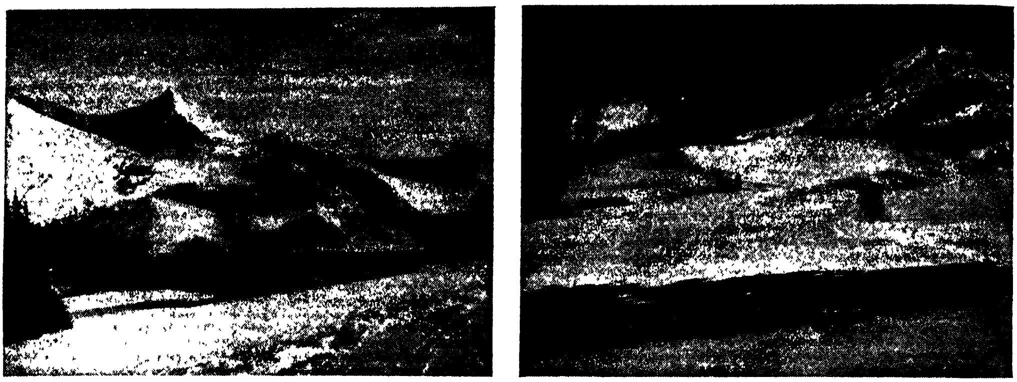




Ewing Galloway
Left: an adobe house in Santa Fe, built in 1636. Right: the Mission of San Xavier, near Tucson, built in 1776.



The old Palace of the Governors, at Santa Fe. It is made of bluish-gray adobe brick and was built in 1607.



Sun Valley, Idaho, a famous winter resort where crisp, snowy slopes offer fine skiing and tobogganing.

to be seen in the West; a belt of shimmering golden sand dunes more than one mile wide and thirty miles long. The dunes vary in height from ten feet to a hundred feet, and they never look twice the same, for they shift constantly with the winds. Idaho has hundreds of caves, but the most remarkable of them all is Crystal Falls Cave with its underground river and waterfall of ice. Perhaps the most wonderful thing in Idaho is the great Shoshone, or Snake, River, especially where it twists its serpentine way northward through Hell's Canyon, the walls of which are in some places 8,000 feet high.

Just south of Idaho we come to Utah, one of the most colorful and picturesque of the western states. Utah, which is just west of the Rocky Mountains, has a number of mountain ranges, including the Wasatch, Sanpitch and Uinta mountains. It also has a desert, an inland sea, and miles of brightly colored canyons in which the rock has been carved by wind and sand into fantastic shapes, pinnacles and temples and palaces.

In contrast to these strange wonders of Nature, Utah has one of the few large cities in the western mountain states, and much fertile land on which are grown sugar-beets, grains, potatoes and many fruits and vegetables. It has also, like the other mountain states, vast mineral wealth.

Salt Lake City, named after the body of water on whose shores it stands, is a commercial and industrial center, but it is most famous as the religious headquarters of the Latter Day Saints, or Mormons, who founded it and made it a great city. Everyone who visits the city marvels at the great Temple and the Tabernacle which can seat twelve thousand people. The University of Utah is in Salt Lake City, and there are other important educational institutions at Provo and Logan.

THE NEXT STORY OF THE UNITED STATES IS ON PAGE 6613.

Photo by Clyde Anderson
Sailing on Great Salt Lake, fifteen miles west of Salt Lake City, is an increasingly popular sport.

1 horse-power = the force required to raise 33,000 pounds one foot in one minute.

1 foot-pound = the energy required to raise one pound a height of one foot.

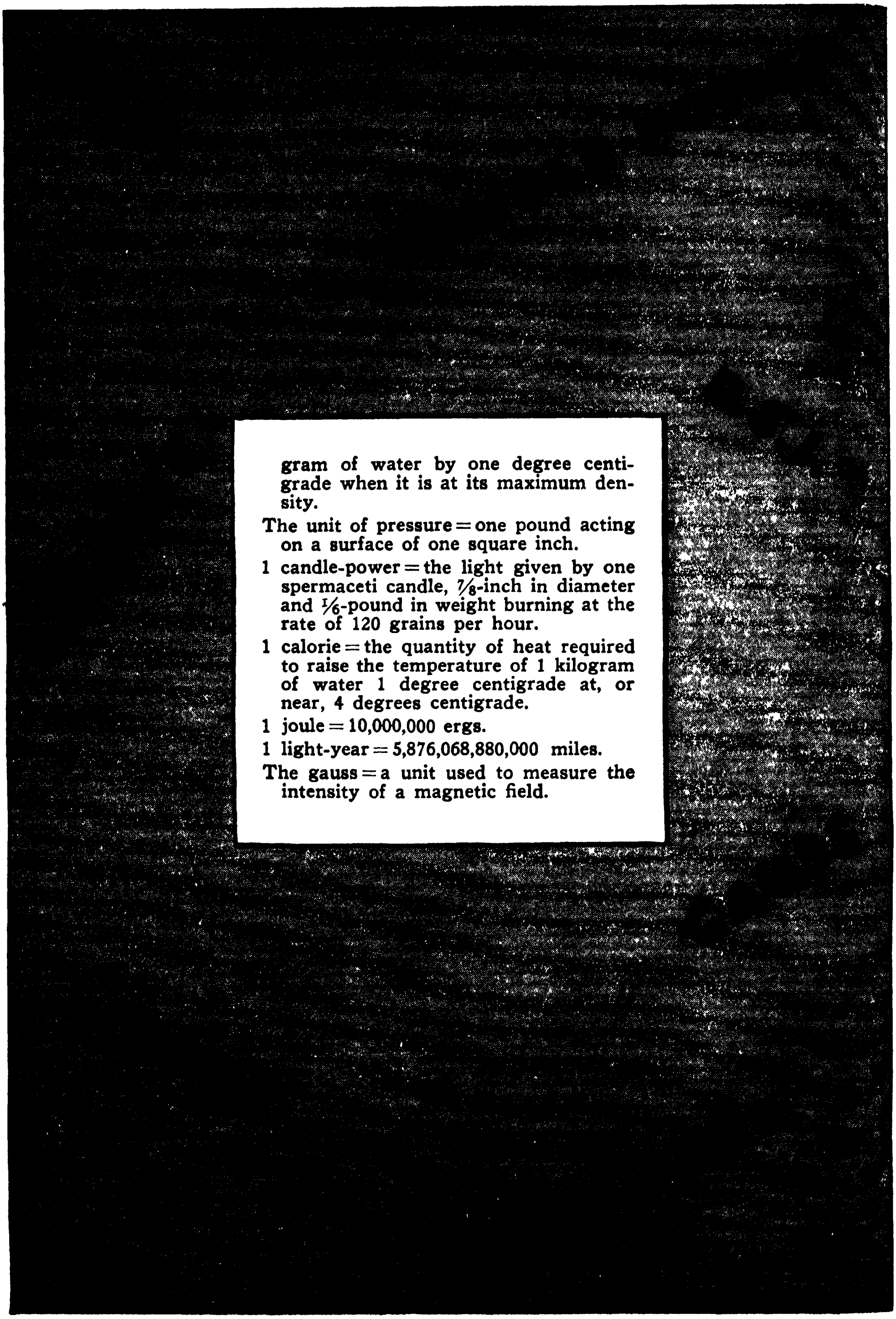
1 dyne = the force which acting on one gram for one second generates a velocity of one centimeter a second.

1 erg = the amount of work done by one dyne acting through one centimeter.

1 poundal = the force which acting for one second upon one pound gives it a velocity of one foot per second. It is equal to 13,825.5 dynes.

1 atmosphere = the pressure of 14.7 pounds per square inch equal to 34 feet of water or 29.92 inches of mercury.

The thermal unit = the quantity of heat required to increase the temperature of one



gram of water by one degree centigrade when it is at its maximum density.

The unit of pressure = one pound acting on a surface of one square inch.

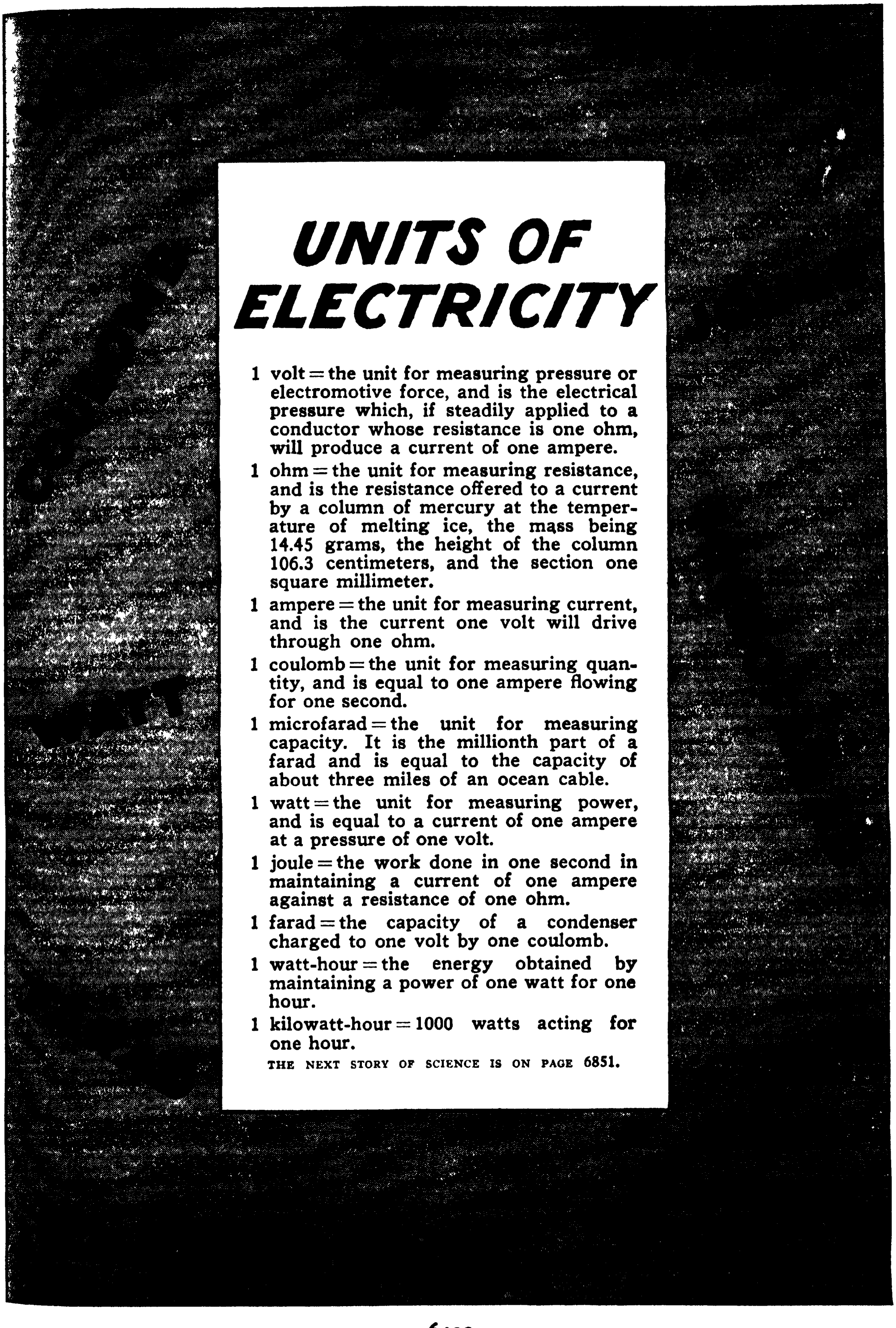
1 candle-power = the light given by one spermaceti candle, ⅞-inch in diameter and ⅙-pound in weight burning at the rate of 120 grains per hour.

1 calorie = the quantity of heat required to raise the temperature of 1 kilogram of water 1 degree centigrade at, or near, 4 degrees centigrade.

1 joule = 10,000,000 ergs.

1 light-year = 5,876,068,880,000 miles.

The gauss = a unit used to measure the intensity of a magnetic field.



UNITS OF ELECTRICITY

1 volt = the unit for measuring pressure or electromotive force, and is the electrical pressure which, if steadily applied to a conductor whose resistance is one ohm, will produce a current of one ampere.

1 ohm = the unit for measuring resistance, and is the resistance offered to a current by a column of mercury at the temperature of melting ice, the mass being 14.45 grams, the height of the column 106.3 centimeters, and the section one square millimeter.

1 ampere = the unit for measuring current, and is the current one volt will drive through one ohm.

1 coulomb = the unit for measuring quantity, and is equal to one ampere flowing for one second.

1 microfarad = the unit for measuring capacity. It is the millionth part of a farad and is equal to the capacity of about three miles of an ocean cable.

1 watt = the unit for measuring power, and is equal to a current of one ampere at a pressure of one volt.

1 joule = the work done in one second in maintaining a current of one ampere against a resistance of one ohm.

1 farad = the capacity of a condenser charged to one volt by one coulomb.

1 watt-hour = the energy obtained by maintaining a power of one watt for one hour.

1 kilowatt-hour = 1000 watts acting for one hour.

THE NEXT STORY OF SCIENCE IS ON PAGE 6851.

From painting by Lieut. Dwight C. Shepler for U. S. Navy

TWO WORLD WARS

OUR century has seen the two most terrible wars in the history of mankind. Because so many nations took part in these struggles, they have been called "world wars." The first lasted from 1914 to 1918; the second, from 1939 to 1945. They were separated, therefore, by a period of twenty-one years. We have come to realize that during this time there was not peace, but a truce—a truce often interrupted by bitter fighting. In this article we shall tell you about the two world wars and the years that lay between.

World War I began by being a European affair. At that time the map of Europe was not as it is today. Austria and Hungary were united to form a mighty empire, called Austria-Hungary, or the Dual Monarchy. Serbia and Montenegro, which are now part of Yugoslavia, were independent kingdoms. There was no Czechoslovakia. Poland was divided up between Germany, Russia and Austria; Finland was a Russian possession. Germany held the provinces of Alsace and Lorraine, which now belong to France.

To understand how World War I began, we must have some idea of the rivalries, hatreds and fears that divided the nations of Europe in the early years of the twentieth century. Great Britain and France and some of the other countries accused Germany of wanting to become the master of the continent. For their part the Germans claimed that Great Britain was jealous of Germany's growing commerce. They also declared that France wanted revenge because she had been defeated by Germany in the Franco-Prussian War of 1870-71.

There was ill will, too, between Russia and Austria. Russia wanted to unite the Slavic peoples of Europe in a union in which Russia—the chief Slav state—would be most important. Three Slavic nations—Serbia, Montenegro and Bulgaria—were neighbors of Austria. If these neighbors accepted the leadership of Russia, Austria feared that her own interests would suffer. She also feared that the Russians had designs on the Slavs living in the Dual Monarchy.

Besides, there was the matter of colonial rivalry among the nations of Europe. In the latter half of the nineteenth century Great Britain, France, Germany, Italy and Belgium had set up a number of new colonies in Africa. As the interests of these countries clashed, there was one crisis after another. Great Britain and France almost went to war over the Egyptian Sudan in 1898. France and Germany quarreled in 1905 and again in 1911 over Morocco.

In this troubled era Europe became an armed camp. The chief nations of the Continent kept enormous armies; Great Britain insisted on having the largest navy in the world. Each of these countries felt that it must protect itself by making alliances with powerful neighbors.

By 1914 the big powers were divided into two rival groups. One of these was the Triple Entente, made up of Great Britain, France and Russia. (Entente, pronounced on-tont′, means understanding.) Germany, Austria-Hungary and Italy were joined together in a Triple Alliance. Hostility between these two groups mounted steadily. It was clear that any incident might lead to a disastrous war. Finally the incident occurred.

On June 28, 1914, the Archduke Franz Ferdinand, heir to the throne of Austria-Hungary, was shot to death with his wife by a student at Sarajevo, in the Austrian district of Bosnia. This district was inhabited largely by Slavs, who were not content under Austrian rule. Austrians declared that Serbia had fanned the unrest in Bosnia. They claimed that Serbia's anti-Austrian policy was responsible for the Sarajevo murders.

AUSTRIA MAKES TEN DEMANDS ON SERBIA AFTER THE SARAJEVO MURDERS

Austria now made ten demands upon the Serbians. Among other things she insisted that Austrian officials should be permitted to help put down the anti-Austrian movement in Serbia. She also wanted to take part in bringing to justice the Serbians who, according to her, were responsible for the assassination of the Archduke and his wife.

On July 25 Serbia accepted all of Austria's demands except the two that we named above. She did not refuse these two. But before she accepted them, she wanted to be sure that she would not become a subject state, meekly carrying out Austria's orders. The Austrian Government decided that the reply of Serbia was unsatisfactory; and on July 28, 1914, she declared war on that country.

Events now moved rapidly. Russia announced that she would not stand by and see little Serbia crushed, and so she began to get together her troops. On July 31, Germany, Austria's ally, demanded that Russia should stop her warlike preparations. At the same time she asked France what she intended to do. Russia did not answer Germany, but continued to get her army ready. France told Germany that she would do what was in her own interest.

The Germans now decided to act. They declared war on Russia on August 1, 1914, and on France two days later. Italy decided to remain neutral. Great Britain's stand was doubtful at first. But a German military move, directed against the neutral state of Belgium, caused the British to make up their minds quickly.

GERMANY INVADES BELGIUM AND GREAT BRITAIN DECLARES WAR

The easiest invasion route for the Germans into France was by way of Belgium. To be sure, Germany, together with the other big powers of Europe, had guaranteed the neutrality of Belgium many years before. But in the famous words of the German chancellor, Von Bethmann-Hollweg, this guarantee was a mere "scrap of paper." On August 2, therefore, Germany asked the Belgians to let her troops pass through their territory. When this was refused, the Germans launched an invasion of Belgium. Great Britain hesitated no longer; on August 4, 1914, she declared war on Germany.

And so now Germany and Austria-Hungary, known as the Central Powers, were at war with the Allies—that is, Great Britain, Russia, France, Serbia and Belgium. The Allies had greater natural resources, a larger population and far greater naval power. On land the two opposing forces were pretty evenly matched. It is true that the Allies had about 10,000,000 men under arms, while the Central Powers had only 8,000,000. But Great Britain and France were separated from their ally, Russia, while Germany and Austria were neighbors and therefore had the advantage of "inside lines."

Germany's chief hope lay in winning the war quickly before the Allies could bring their superior numbers and resources into play. She planned to hold off Russia at first and to crush France in the west; then, with Austrian aid, she would defeat Russia. So the German armies poured into Belgium on their way to France. The Belgians fought bravely, but they were overpowered. Their capital, Brussels, was captured on August 20, and soon the Germans were masters of almost all of Belgium.

The French and British had rushed troops

Brown Brothers

A lull in the fighting at Ypres, in Belgium, in World War I. Continuous shellfire reduced much of this city to ruins.

into Belgium, but these had failed to halt the German invaders. The Germans now streamed into France, driving the Allied armies before them. At last the Allies halted their retreat at the Marne River; at one point their lines were only twenty-five miles from Paris. There now followed one of the most decisive battles of all time—the First Battle of the Marne. It lasted from the 5th to the 9th of September, and it resulted in a great Allied victory. The German drive toward Paris was definitely stopped.

The Allies hoped to drive the enemy out of France altogether. But the Germans retreated only to the north of the Aisne River; and there they remained. By the middle of November the battle lines in western Europe formed a continuous front. This front extended from the English Channel to the Swiss frontier—a distance of more than 500 miles. This line was known throughout the war as the Western Front. The opposing forces set up a complicated system of trenches along the Western Front.

The Russian armies had invaded the German province of East Prussia soon after the beginning of the war. The British and French expected great things of their ally. But the German general Von Hindenburg routed the Russians at Tannenberg (August 26-30, 1914) and drove them out of German territory. Russia was more successful against Austria; her troops overran the Austrian province of Galicia. Nor were the Austrians able to accomplish much against little Serbia.

Allied naval might made itself felt from the beginning. The British and French fleets drove German merchant shipping from the high seas and set up a successful blockade of Germany. But the Germans were by no means inactive at sea. The chief German threat was the U-boat, or submarine. At first the submarine was used mainly against warships. Later it was used with great effectiveness against merchant ships, even those of neutral countries.

In the first few months of the war German surface craft also caused considerable damage. When the war began, a number of German warships, making up the Far Eastern Fleet, were cruising in the Pacific. One of these ships, the Emden, was sent off to prey on Allied shipping. It sank many vessels before it was finally forced aground on the Cocos Islands on November 9, 1914, by the Australian cruiser Sydney.

In the meantime the German Far Eastern Fleet had defeated a British squadron off Coronel, Chile, on November 1, 1914. Another British squadron, commanded by Admiral Sturdee, avenged the Coronel defeat by sinking four vessels of the German Far Eastern Fleet off the Falkland Islands on December 8.

More nations had entered the war by the end of 1914. Montenegro joined the Allies on August 8. On August 23 Japan declared war on Germany; several months later she captured Kiaochow, a German possession in China. The Turks threw in their lot with the Central Powers in October. They began an advance on the Suez Canal in the following month, but they were thrown back.

In February, 1915, an Allied expedition set out to capture the Turkish capital, Constantinople, and to open the straits between the Black and Mediterranean seas to Allied shipping. On February 19, Allied warships began to bombard the Turkish positions along the strait of the Dardanelles. The attack was carried on for a month or so. At last the Allied squadron, having suffered heavy losses, had to withdraw.

In April the Allies returned to the attack. This time the British succeeded in landing troops, including many men from Australia and New Zealand, on the Gallipoli Peninsula below Constantinople. The Turks, under German leadership, resisted stubbornly, and the invaders could not advance. They clung grimly to their positions, despite heavy enemy fire, for many months. At last, in January, 1916, they gave up the campaign.

Three months after the first attack in the Dardanelles area, Italy joined the ranks of the Allies. The alliance with Germany and Austria-Hungary had never been popular with the Italian people; and pro-Allied feeling had been stirred up by the great Italian poet, Gabriele d'Annunzio. On May 23, 1915, Italy declared war on Austria-Hungary. (She did not go to war with Germany until August 27, 1916.) The Italians put an army of 1,500,000 men in the field. By the end of 1915 Italian troops had advanced into southern Austria, in the region of the Alps Mountains.

The Central Powers won a series of important victories on the eastern front in 1915. Alone, the Austrians had done nothing; but they now had the help of the Germans, who sent troops from the west. In May and June the German general Von Mackensen drove the Russians out of most of Galicia. Several months later General von Hindenburg captured Warsaw and conquered the greater part of Russian Poland. Russian losses were enormous in these campaigns. Two million men were killed or wounded and a million were captured. Russia's war effort was crippled.

In October the German and Austrian armies turned their attention to Serbia. They were aided by Bulgaria, which proclaimed that she was going to fight "on the side of the victors." An Allied army which had landed at Salonika, Greece, a short time before, marched to the aid of the Serbians. But the combined German, Austrian and Bulgarian forces swept everything before them. Serbia was overrun; the Allied expeditionary force had to retreat to Salonika.

THE GERMANS USE POISON GAS FOR THE FIRST TIME IN AN ATTACK ON YPRES

On the Western Front there was much violent fighting in 1915, but few advances to show for it on either side. In April the Germans made a murderous attack on Ypres, in Belgium. They used poison gas in this attack—the first time that this terrible weapon had ever been used in warfare. The British had to retreat. But they re-formed their lines and succeeded in holding the foe at bay. At about the same time the French launched an offensive in Champagne and Artois, but this effort was not very successful In the fall the Allies attacked in the Argonne. Gains were small; losses were heavy.

In the early part of 1915 Germany decided to set up a blockade of her own by means of her U-boats. She announced on February 17, 1915, that German submarines would sink all enemy merchantmen in the waters around the British Isles. It soon became clear that U-boat commanders intended to torpedo enemy merchant ships without warning and that they would make no effort to save lives.

This unrestricted submarine warfare, as it was called, violated the generally accepted rules of naval combat. Hitherto warships had been required to give warning to enemy merchantmen before attacking them, and they had also been required to provide for the safety of those aboard such vessels.

The U-boats now claimed many victims, including a number of neutral vessels. The most famous of these victims was the huge British passenger liner Lusitania, which was sunk on May 7, 1915. Over a hundred Americans lost their lives on the Lusitania and President Wilson of the United States protested vigorously. In the following months he made other protests as the submarine campaign continued. At last on May 4, 1916, Germany promised that her submarines would no longer sink merchantmen and passenger ships without giving due warning.

THE GERMANS LAUNCH A SERIES OF VIOLENT ATTACKS ON VERDUN IN 1916

The Germans made a determined effort to make a break-through on the Western Front in the early months of 1916. In February they launched a violent attack upon the French positions at Verdun, not far from the Belgian border. There followed a bloody struggle that raged for five months. The Germans, disregarding their losses, kept pouring in fresh troops. The French, with the battle cry "They shall not pass!" on their lips, held firm. At last, after half a million Germans had been killed or wounded or taken prisoner, the German Emperor called a halt. General Henri Philippe Pétain, who had defended Verdun, was hailed as a hero. We shall meet Pétain again.

The greatest sea battle of the war was fought in 1916. On May 31 of that year, shortly after midnight, the German High Seas Fleet left port in order to hunt down the British warships stationed in the Skagerrak, an arm of the North Sea south of Norway. Later that day the German ships met the British Grand Fleet off Jutland, Denmark. Neither side won a decisive victory. The British suffered greater losses than the foe. On the other hand, the German warships had to retire to their bases. Never again did they come out to do battle with the warships of the big British Navy.

In the month of July, 1916, the Allies launched a vigorous attack along the Somme River. After four months of desperate fighting, the Allies had to give up their offensive. They had pushed the Germans back somewhat in this area, but at the cost of 500,000 killed, wounded or missing in action.

The Allies gained a new ally in the east when Rumania went to war with Austria on August 27, 1916. Rumania gained some successes against the Austrians in Bukovina. As always, the Germans came to the rescue of their allies. The Rumanians were caught between the Austrians and the Germans and suffered a series of crushing defeats. By the end of 1916 most of Rumania had fallen into the hands of the Central Powers.

As 1917 opened, there was great discontent in Russia. The people were tired of the war, which had brought nothing but disaster to their country. Many workers went out on strike by way of protest; there were uprisings among the peasants in the country districts. The members of the Duma, or Parliament, denounced the weakness of the Government and demanded a change.

Nicholas II, the tsar (emperor) of Russia, determined to stamp out this spirit of revolt. He issued a decree ordering the Duma to adjourn and forbidding the workers to continue their strikes (March 11, 1917). At once revolution broke out; and on March 15, Nicholas gave up his throne. A provisional (temporary) government was set up. It promised that the Russians, freed from their despotic Tsar, would continue the fight against the Central Powers with greater enthusiasm than before.

The Allies were delighted. Their hopes were raised even more when, in the following month, the United States entered the war on their side. Under President Wilson America had tried to remain neutral. It had been difficult to carry out this neutrality policy, because both warring groups had done things to which Americans had objected. The United States protested when the Allies insisted on searching American ships bound for neutral ports. She protested even more bitterly when German U-boats sank, without warning, merchant ships and passenger liners carrying American passengers.

On January 31, 1917, Germany announced that her U-boats would engage in unrestricted submarine warfare in the waters around Great Britain, France and Italy. The rate of sinkings mounted; a number of American vessels were among those lost. Public indignation in the United States rose high. At last, acting on the recommendation of the President, Congress declared war on Germany, April 6, 1917.

American warships soon proved to be helpful in the never ending campaign against Germany's U-boats. But the Allies also desperately needed fresh troops to make up for their losses. The American regular army was

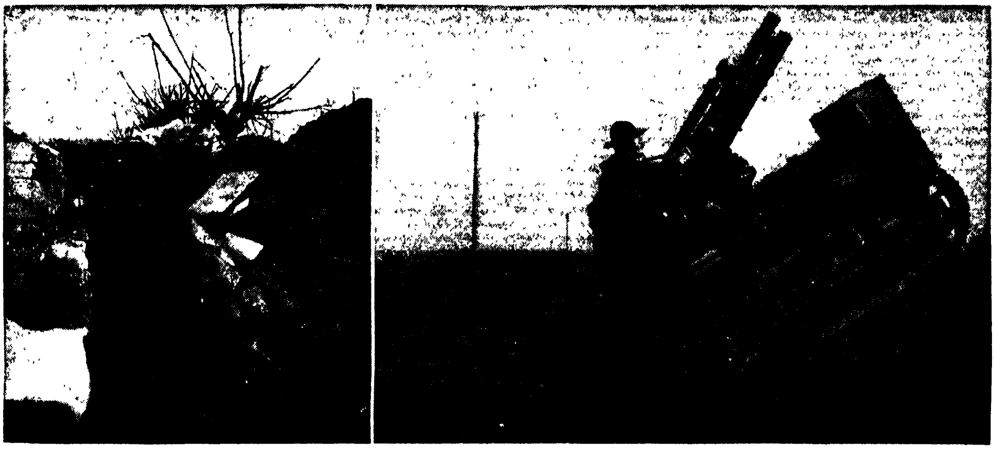
Kadel and Herbert, N. Y.

General John J. Pershing, commander of the A. E. F. (American Expeditionary Force) in World War I, reviews a detachment of French sailors at the port of Boulogne. Pershing is accompanied by the French general Pelletier.

SCENES FROM THE FIRST WORLD WAR

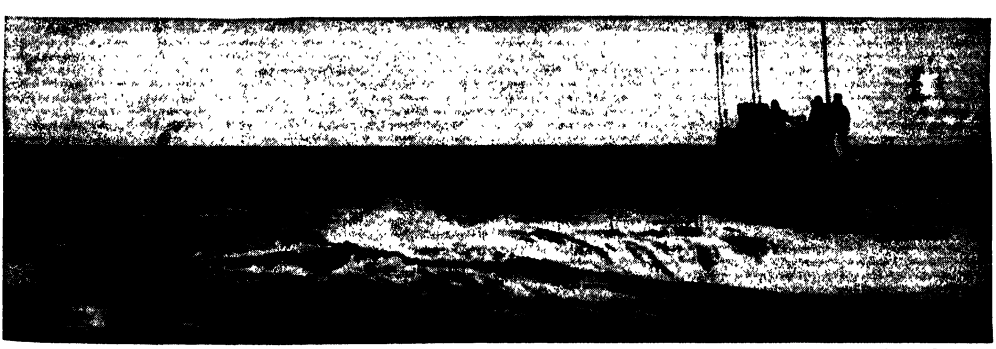
Photo by Ruschin Official U. S. photo

Left: a German captive balloon of the Caquot type about to take off. Balloons of this kind were used to direct artillery fire. Right: an American soldier equipped with a gas mask as a protection against poison gas.



Feature Photo Service Official U. S. photo

Left: a German trench near Arras, France, in the early days of World War I. As time went on, trenches became more and more complicated. Right: an early American version of an anti-aircraft gun, mounted on a tractor.



Feature Photo Service

This German submarine, the U5, measured 141 feet 8 inches in length and had two torpedo tubes. Submarines like this proved to be Germany's most effective naval weapon in World War I; they took a heavy toll of Allied ships.

British official photo

A British women's army unit resting in barracks.

very small. It would take months to train new troops; then it would be necessary to transport them 3,000 miles across the Atlantic Ocean. Would American armies arrive in time on the field of battle?

When Greece entered the war on the Allied side in July, 1917, the Allied position in the south was strengthened. But this favorable development was more than offset by happenings in Russia. The Russian soldiers refused to follow their officers into battle. Together with peasants and workers, they formed local councils, called soviets, and these demanded peace.

As time went on, the soviets acquired more and more power. They were directed chiefly by the leaders of the radical Bolshevik party. At last, on November 7, 1917, the Bolsheviks overthrew the provisional authorities and set up a communist government. This government opened peace negotiations with the Central Powers in December, 1917. By that time the eastern front had really ceased to exist.

Disaster had also struck the Allied cause in the south. The Germans, relieved of pressure in the east, had sent reinforcements to the Austrians on the Italian front. On October 24, 1917, the combined German and Austrian armies struck at the Italian positions at Caporetto. The Italians were routed and fled in great confusion. The Germans and Austrians advanced to the Piave River. Here, with British and French aid, the Italians made a stand at last.

The Allies were on the defensive as the year 1918 opened. More and more German troops were being brought to the Western Front from the Russian area. This movement of troops increased greatly after Russia and the Central Powers signed the Peace of Brest Litovsk on March 3, 1918. American troops, it was true, were now landing in France in considerable numbers; but they were as yet untried in battle.

All now expected a formidable German attack on the Western Front. It came at last on March 21, 1918. The Germans struck at the British lines near St. Quentin, in northeastern France, and forced the British to retreat. In May the Germans attacked the French positions along the Aisne River, and won a great victory. Then they pressed on until they reached the Marne River, the high-water mark of their advance in 1914.

The enemy advance was halted for a time, as the Germans gathered together their forces for a supreme effort. The Allies took full advantage of this breathing space. The French general, Ferdinand Foch, who had become supreme commander of the Allies in the west, ordered every available American division to be rushed to the front.

THE SECOND BATTLE OF THE MARNE ENDS IN A DECISIVE ALLIED VICTORY

On July 15, 1918, the Germans launched a violent attack on the Allied lines. They advanced in several areas, but on the 18th the Allies struck a fierce counter-blow. After two weeks of heavy fighting, the Germans had to retreat to the Vesle River. The Second Battle of the Marne, like the first, had ended in an Allied victory.

This was the beginning of the end. From now on the Allies struck one hammer blow after another at the weakened German armies, which had to begin a general retreat. Then, one by one, Germany's partners gave up the struggle. Allied troops invaded Bulgaria from the south and that country, unable to obtain help from either Germany or Austria, surrendered on September 29, 1918. Turkey yielded on October 31, following brilliant campaigns by the British, under General Allenby, in Palestine and Syria.

The Austrian troops in Italy were routed by a fierce Allied attack, and by the end of October, the Austrian armies had been smashed to bits. On November 3, Austria, Germany's last ally, surrendered. Revolution now broke out in Germany; the German Emperor fled across the border into Holland. On November 11, 1918, the Germans signed an armistice. The war was over at last, and the whole weary world rejoiced.

Beginning as a minor war between Austria and Serbia, it had become a world struggle in which twenty-nine nations had taken part. It had cost the lives of more than eight million fighting men and hundreds of billions of dollars. Great areas of France, Belgium, Poland and Italy had been laid waste; millions had been made homeless.

Many new weapons had been developed in the course of the war. Both sides used poison gas after the Germans first introduced it in 1915; and gas masks were invented to provide protection against it. Poison gas added greatly to the horrors of warfare; so did flame throwers, which sprayed men with flaming liquid. The Germans perfected a long-range gun — the Big Bertha — which bombarded Paris from a distance of seventy miles. The British created the tank, an armored vehicle that was very effective against infantry. The submarine was not a new instrument of warfare; never, however, had it been used so effectively as in World War I.

In this war air power played an important part for the first time. Balloons had been used for observation purposes in previous wars, but only to a limited extent. Lighter-than-air craft were used more in World War I than ever before. Captive balloons (balloons held fast by means of cables) served to spot enemy movements and to direct the fire of the artillery. Huge dirigibles, called zeppelins, bombed London and other British cities.

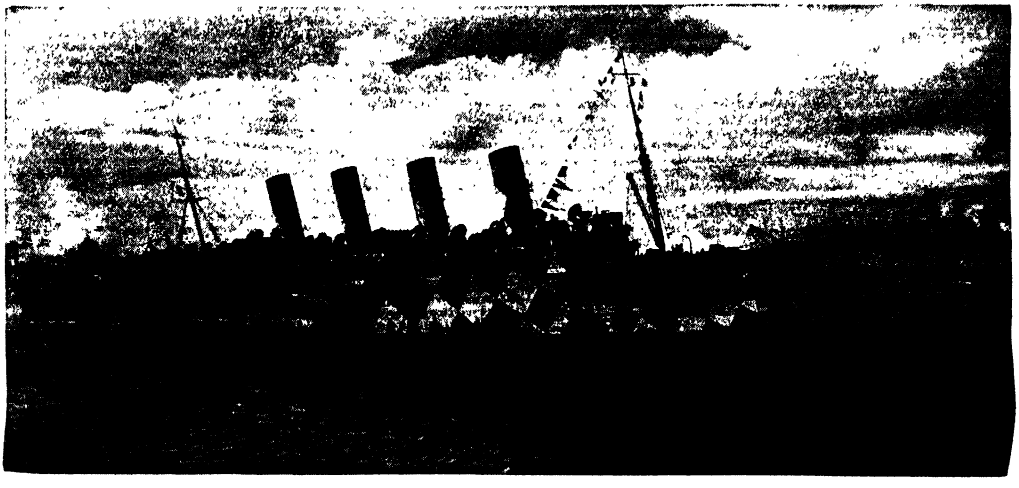
Airplanes proved to be much more effective than either balloons or dirigibles. The lighter planes directed artillery fire, scouted the movements of enemy troops, attacked ground forces with machine-gun fire and tried to knock enemy planes out of the sky. The heavier planes dropped bombs on enemy positions, and on cities and industries behind the lines. The side that won control of the air had a great advantage.

After the war thinking people all over the world became frightened for humanity, in the face of these terrible weapons—poison gas, the flame thrower, the long-range gun, the submarine, the bombing plane. The victors, therefore, announced that they were determined to bring about a peace that would last. It was to be based on fourteen points set forth by President Wilson in a message to Congress on January 8, 1918.

Among these were: (1) open agreements, openly arrived at; (2) the right of each people to choose its own form of government; (3) the setting up of a league of nations to guarantee the independence and the safety of all countries.

On January 18, 1919, representatives of twenty-seven nations met at Versailles, near Paris, in order to arrange the final terms of Germany's surrender in accordance with Wilson's program. It took more than five months for the delegates to complete their work; and in the course of this time they lost sight of some of the fourteen points.

At last the peace treaty with Germany was ready. It was signed by Allied and German representatives on June 28, 1919, at Versailles; and thereafter it was always referred to as the Treaty of Versailles. In the months that followed, the Allies signed peace treaties with Austria (September, 1919), Bulgaria



How camouflage (disguise) was used on Allied ships in World War I as a protection against German submarines.

(September, 1919) and Turkey (August, 1920).

The Treaty of Versailles and the other peace treaties dealt with the reparations that the Central Powers would have to pay to the victors. They also made over the map of Europe and distributed lands in other parts of the world. France won the provinces of Alsace and Lorraine, taken from her by Germany in 1871. She also received the German district of the Saar for fifteen years. At the end of that time a plebiscite, or vote of the people, was to be taken to decide to which country the Saar would belong permanently. Italy, Rumania, Greece and Belgium added to their territory; so did the neutral state of Denmark.

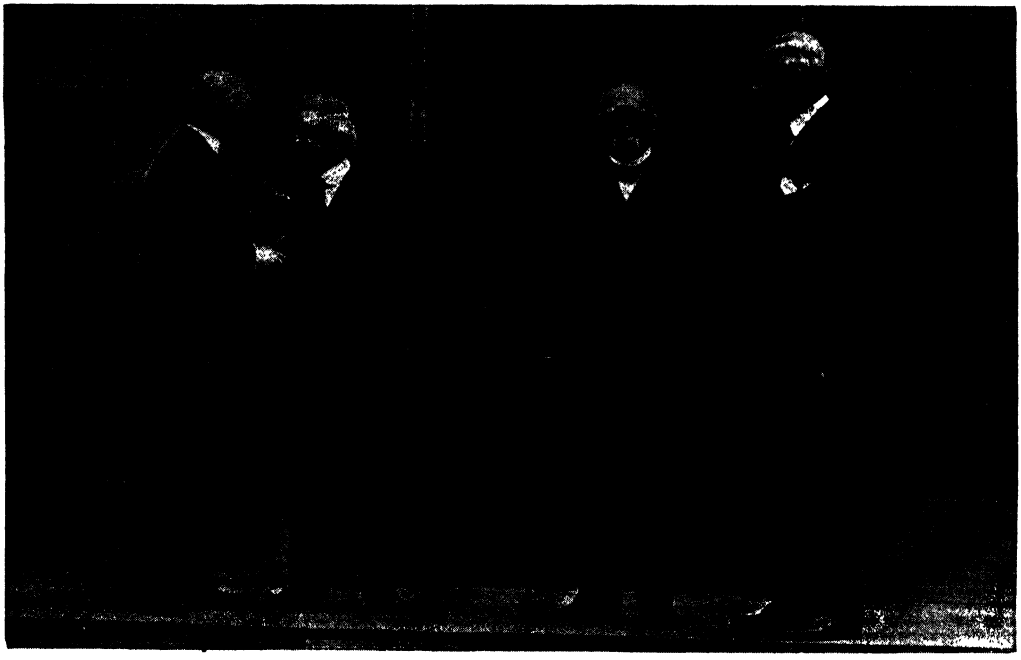
Germany had to give up considerable land in Europe. She also lost all her colonies, which were divided up between France, Belgium, Japan, Great Britain and the British dominions. Austria and Hungary were separated. Austria was reduced to its capital, Vienna, and a small area around it; Hungary lost three-quarters of her former territory. Bulgaria and Turkey also had to yield land to the victorious Allies.

In the new map of Europe there now appeared a group of nations that had not figured there at the outbreak of World War I. These nations were Yugoslavia, Poland, Czechoslovakia, Finland, Estonia, Latvia and Lithuania. They were formed from land taken from Germany, Austria and Russia.

Of all the peace treaties the Treaty of Versailles was the most important. Not only did it draw up peace terms with Germany, by far the most powerful of the Allies' foes in World War I, but it also set up a new League of Nations. This League was to be made up of all the Allied countries and all the neutral states that wished to join. As for the former enemy states, they would be permitted to enter the League when they showed themselves worthy of that privilege.

The League was to settle disputes that arose among its member states. If, disregarding the League's recommendations, one member state went to war against another, the rest were to boycott the offender. The League might also recommend that the member states should use their armies and navies to enforce peace. Even if two quarreling nations were not members of the League, it might intervene if the dispute threatened the peace of the world. In addition to its efforts to prevent war, the League interested itself in the general welfare of the member states and the peoples of the world in general. (See Index, under League of Nations.)

A severe blow was dealt to the League at the very outset. The United States Senate



U. S. Signal Corps photo

The "Big Four" at the peace conference of 1919. Left to right: Lloyd George, Orlando, Clemenceau and Wilson.

refused to ratify the Treaty of Versailles, and hence also rejected the League. The United States, however, sent observers to many of the League's sessions, and had representatives on some of its bureaus. And so the supporters of the new organization were not discouraged. They thought that it would bring about an era of permanent peace. Their hopes, alas, were not to be fulfilled.

The twenty years between the signing of the Treaty of Versailles in 1919 and the outbreak of World War II in 1939 may be divided roughly into two periods of ten years each. The first of these periods (1919-1929) was not particularly peaceful. There were bitter quarrels between nations and there were even several wars. There was a revolution in Italy, where Benito Mussolini set up his fascist dictatorship in 1922. (See the Story of Italy.) There was almost continuous civil war in China.

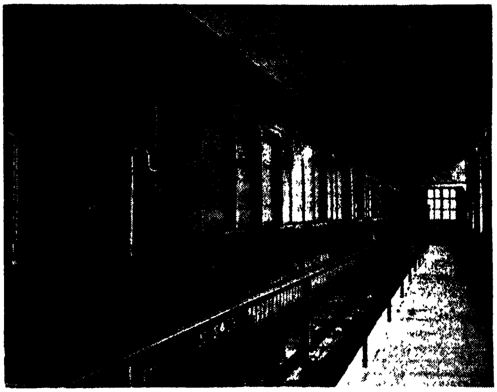
Yet, on the whole, the general desire for peace in this era was strong. The League of Nations managed to patch up a number of quarrels between its member states. Other promising steps were taken to strengthen the cause of peace. In 1922, following a conference held in Washington, the United States, Great Britain, Japan, France and Italy agreed to limit the size and number of their battleships.

THE KELLOGG PEACE PACT, WHICH WAS SUPPOSED TO OUTLAW WAR BETWEEN NATIONS

In a series of treaties signed at Locarno, Switzerland, in 1925, Germany, Belgium and France agreed never to go to war with one another. In the year 1928 fifteen states signed the Kellogg Peace Pact, named after the American Secretary of State, Frank B. Kellogg. The pact was an agreement to give up war and to use only peaceful means in settling disputes. Thirty more nations signed the agreement not long afterward. It went into effect on July 24, 1929.

All this was encouraging. Unfortunately, the Locarno treaties and the Kellogg Peace Pact were weakened by clauses permitting nations to go to war in self-defense. Quarrelsome nations often claim that they are acting in "self-defense" when they attack peaceful neighbors.

In the year 1929 there began a terrible depression that soon gripped all the countries of the world. There was mass unemployment and great suffering among working people. Some countries tried to revive their industries by raising tariffs and thus keeping out the products of other countries. Naturally international trade decreased. The spirit of co-operation among nations was fatally weakened, as each tried to set its own house in order. A new era of international rivalry began.



Courtesy, Railways of France

In this car, in the Forest of Compiègne, the Germans signed the armistice in 1918. In this same car, in 1940, the nazi conquerors dictated terms to the French.

This spirit of rivalry took violent form in 1931. In that year Japan invaded the Chinese province of Manchuria, claiming that the bandits of the province were endangering her interests. She easily conquered the province and set up a puppet state, called Manchukuo, in that area. All eyes were turned to the League of Nations. One of its member states had attacked another; what would it do? It did very little indeed. It went so far as to declare Japan an aggressor (attacking) nation, in 1933; but that was all. Japan left the League and went about the business of digesting Manchukuo.

The cause of peace suffered another severe blow when Adolf Hitler and his National Socialist, or Nazi, party came into power in Germany in 1933. After the downfall of their emperor the Germans had set up a republic. It had been weakened by constant quarrels between different groups. The Nazis called for a united and powerful Germany. To bring this about, they set up a brutal dictatorship which crushed all freedom of thought and demanded blind obedience to the nation's leaders. Following these leaders, the German people now entered upon a road that led to war.

In January, 1935, the inhabitants of the Saar voted to return to the German Reich (state). The Nazis were greatly enheartened by this addition to their territory. They now made no effort to conceal their ambitious plans. In March, 1935, Hitler announced that he intended to establish an army of 500,000 men—400,000 more than the Treaty of Versailles permitted. However, to quiet the fears of Great Britain and France, the German dictator promised that he would seek no more territory in the west, now that the Saar had been returned to Germany.

In 1935 the League of Nations was put to the test again. Fascist Italy, a member of the League, invaded the territory of a fellow-member, Ethiopia, in October. This time the League went so far as to apply "economic sanctions"—that is, it recommended to its member states that they should ship no arms, steel or iron to Italy and that they should boycott Italian imports.

MUSSOLINI CONQUERS ETHIOPIA AND ADDS IT TO THE ITALIAN EMPIRE

But the economic sanctions did not go far enough, since they did not ban the export of oil to Italy. Furthermore, the League did not recommend the use of force against the Italians. Disregarding the League, Mussolini went ahead with his Ethiopian campaign. Ethiopia was hopelessly ill-equipped for modern warfare; she was conquered and annexed to the Italian Empire in May, 1936.

In March, 1936, the Nazis, encouraged by Mussolini's defiance of the League, made another bold move. They sent troops into the German districts that lay along the Rhine River, in violation of a provision of the Versailles Treaty. France was ready to use her armies to oppose this move. But Great Britain refused to back her up, and France did not wish to act alone. Again Germany had her way.

The two dictators, Hitler and Mussolini, now decided that they ought to join forces; so they formed what they called a Rome-Berlin Axis. An axis, you know, is a line about which something turns. The dictators of Germany and Italy confidently expected that in time the whole world would turn about the Rome-Berlin Axis.

A revolt in Spain soon gave the Axis partners a chance to show the world how well they could work together. Spain had been a republic since 1931. In July, 1936, a large part of the army rebelled against the Government and civil war began. Italy and Germany sent aid openly to the rebels; Russia helped the Loyalists—the supporters of the Government—just as openly.

Great Britain and France remained neutral and tried to persuade the other countries of Europe to keep hands off, too. But Germany and Italy continued to give their support to the rebels; and in time Russia withdrew her aid to the Loyalists. By March, 1939, the rebel forces, under General Francisco Franco, had crushed all resistance. Franco proceeded to set up a fascist government.

In the meantime, the Japanese had continued their career of conquest at China's expense. In July, 1937, without a formal declaration of war, they launched an attack upon China. The Chinese soldiers, brave but ill-equipped, could not hold off the invaders, and the Japanese occupied a great deal of territory. Yet, under the leadership of Chiang Kai-shek, the Chinese fought on stubbornly.

By now the Treaty of Versailles was only a scrap of paper, which almost everybody ignored. The only question was how far the democratic states of Great Britain and France would let the Axis powers go. When the democratic states permitted Germany to annex Austria in March, 1938, without a protest, it certainly seemed that they would do almost anything to avoid going to war.

Hitler now turned his attention to the small and peaceful democracy of Czechoslovakia. He pretended to be indignant at the way the Czechs were treating the Germans in that country. He demanded, therefore, that the district of the Sudetenland, where the Germans were numerous, should be turned over to him.

BRITAIN AND FRANCE APPEASE HITLER AT THE EXPENSE OF CZECHOSLOVAKIA

Ignoring the League of Nations, Great Britain and France determined to "appease" the dictator at the expense of Czechoslovakia. In September, 1938, they signed an agreement with Germany and Italy at Munich. This Munich Pact, as it was called, gave Hitler what he wanted, for he was permitted to annex the Sudetenland. The German dictator now declared that he wanted no more European territory. Prime Minister Chamberlain of Great Britain declared that he had brought "peace in our time" to the British.

But in March, 1939, Hitler announced that Czechoslovakia had become "insolent." The nazi legions marched in from the west, while Hungarian troops invaded the eastern part of the country. Soon Czechoslovakia had ceased to exist. Most of it was divided up between Germany and Hungary. The rest of it became a puppet state, under the name of Slovakia. A puppet state is a weak nation ruled by a strong one while pretending to have a free government.

British official photo

The withdrawal from Dunkirk, from a painting by Charles Cundall. Trapped in Belgium toward the end of May, 1940, the British managed to retreat to Dunkirk, France. Many were rescued by a fleet of warships and civilian craft.

Great Britain and France were outraged by Hitler's treachery, but they failed to act. They realized, however, that their appeasement policy had been a dismal failure.

They saw that the Axis powers could be stopped only by force. And so they began to prepare themselves for the war that seemed certain to come.

Mussolini decided that it was again his turn to gain some territory. The Italians had acquired special privileges in Albania, which was supposed to be an independent kingdom; but they considered that these privileges were not enough. They launched a sudden attack on that little country on April 7, 1939, and overran it in a few days. The King of Italy became also the King of Albania.

It was now Poland's turn to feel the dreadful effects of "peace in our time." Hitler had signed a treaty of friendship with that country in 1938, but this did not stop him from seeking a quarrel with the Poles. The Treaty of Versailles had given Poland a strip of land, called the Polish Corridor, that cut off East Prussia from the rest of Germany. Danzig, at the Baltic end of the Corridor, had been declared a free city. Hitler now demanded that Danzig should be restored to Germany. He also wanted a strip of land to connect East Prussia with the rest of Germany: that is, a "corridor across the corridor." This the Poles refused.

Great Britain and France were desperate. They realized that the Nazis must be stopped now, or Europe would be doomed. So they offered to come to Poland's aid if she were attacked by Germany. They also sought to obtain Russia's help in case war broke out. But Poland seemed to fear Russia as much as Germany; and the negotiations with Russia got nowhere.

Nazi diplomats now scored an astonishing triumph. On August 23, 1939, Germany and Russia signed a ten-year pact, in which each agreed not to take arms against the other if war broke out in Europe. Having assured himself of Russia's neutrality, Hitler decided that it was time to act against the Poles. Apparently he thought that Great Britain and France would abandon Poland as they had abandoned Czechoslovakia.

On September 1, without a formal declaration of war, the Germans launched an invasion of Poland. The democracies no longer hesitated. They demanded that Germany should withdraw her troops from Poland at once. This demand was refused; and on September 2, Great Britain and France declared war. World War II had begun.

As in the case of World War I, this was at first a European war; it involved four powers: Germany, Poland, Great Britain and France. (Italy, Germany's Axis partner, remained neutral at first.) As time went on, however, almost all the nations of the world were drawn into the struggle. Well did it deserve the name of World War II.

Since Poland received no help from either Great Britain or France, she had to face all by herself the powerful military machine that the Nazis had built up since they came to power. In the *Blitzkrieg*, or lightning war, that followed, German armored columns, infantry and air might completely crushed the Poles. As Poland was reeling under the nazi attack, the Russians moved in from the east, meeting with no opposition. Soon all fighting was at an end. On September 29, Germany and Russia signed a treaty by which they divided Poland between them.

THE WARRING POWERS PLAY A WAITING GAME AFTER THE SURRENDER OF POLAND

There was little land fighting between Germany and her foes during the rest of 1939. The French-German border was heavily fortified: on the German side, by the Siegfried Line, or West Wall; on the French side, by the Maginot Line. The Allies decided not to try to crack the Siegfried Line, but to play for time. They would set up a blockade of Germany, and they would wait patiently for Germany to give up the struggle for lack of supplies.

For her part, Germany was also content to play a waiting game on land for a while. At sea her U-boats became active, as they had in World War I. They soon began to take a heavy toll of Allied shipping.

Before the year 1939 drew to its close, two hitherto neutral countries, Russia and Finland, went to war. Russia had demanded that Finland should give up considerable territory along the Finno-Russian border. When Finland refused, the Russians launched an attack with land, air and sea forces. Little Finland astonished the world by defeating the Russians again and again. But at last Russia's overpowering might was too much for her foe, and Finland was forced to make peace (March, 1940).

The southern boundary of Finland was pushed back and Russia also obtained certain areas in northern Finland. She soon acquired more new territory. In 1939 she had established military and naval bases in the Baltic republics of Estonia, Latvia and Lithuania. In June, 1940, she occupied all three countries. They entered the Union of Soviet Socialist Republics in the following month.

On April 9, 1940, Germany suddenly struck again. She decided that it was time to "protect" Norway and Denmark from Allied plots, and so she invaded those two neutral countries. Denmark submitted to nazi occupation without a struggle. The Norwegians offered a certain amount of resistance, but the Allies could not send enough help. By June all of Norway was in the hands of the Germans.

On May 10, 1940, the Nazis directed their armies against the neutral states on their western frontier: Luxemburg, the Netherlands and Belgium. They occupied Luxemburg without a struggle; they overwhelmed the Netherlands within five days. The Allies sent troops to try to hold off the onrushing Germans; but it was too late.

When King Leopold III of Belgium surrendered his whole army to the Germans on May 28, the Allied line in Belgium collapsed. The British troops in that area were in danger of being wiped out, but they managed to retreat to Dunkirk, in France. Most of them, about 350,000 men, were rescued and brought to England by Allied warships and by all kinds of British civilian craft—fishing boats, private yachts, motor boats. The rescued British soldiers had lost all their heavy equipment—guns, tanks, trucks and so on.

ITALY ENTERS THE WAR ON GERMANY'S SIDE AND FRANCE HAS TO SUE FOR PEACE

Northern France was soon in the hands of the Nazis. At this critical moment Italy entered the war on Germany's side (June 10, 1940). Now that the fighting seemed to be almost over, Mussolini was anxious to obtain his share of the plunder. France had to sue for peace; and an armistice was signed on June 22, 1940. By the terms of this agreement Germany occupied the northern part of France, including the entire Atlantic coastline; the French were permitted to govern the southern part of the country.

A fascist type of government was set up at Vichy, in unoccupied France, in July, 1940, under Marshal Pétain, who had won fame for his defense of Verdun in World War I. Pétain's government, which came to be called the Vichy Government or simply Vichy, cooperated closely with the Germans. Not all Frenchmen, however, accepted the nazi yoke. A group known as the Free French carried on the fight against the Axis outside of France, under the leadership of General Charles de Gaulle.

Total Axis victory seemed close at hand; and Hitler waited happily for Great Britain to beg for peace. But peace was far from the thoughts of the British. Under the lead-

British Information Services
British commandos heading for enemy territory.

ership of the great Winston Churchill, who had become prime minister in May, 1940, they resolved to fight to the death.

The Nazis decided to bomb Great Britain into submission. In August, 1940, they began a series of daylight air raids that laid many districts of England's cities in ruins. The British Royal Air Force, greatly outnumbered but skillful and courageous, struck back. So heavy were the losses suffered by the German bombers that they were forced to give up their daytime raids. The night bombing that followed also caused heavy damage. But it became more and more clear that the British could not be brought to their knees by bombing alone.

Fascist Italy, conqueror of weak Ethiopia and defenseless Albania, decided in October, 1940, to win new glory by adding little Greece to her victims. Italian troops invaded Greece from Albania and seemed assured of an easy triumph. But to the Italians' dismay the Greeks fought back fiercely. Soon the fascist invaders were in full retreat with the Greeks at their heels.

The Italians also met with disaster in North Africa. They had invaded Egypt from Libya in October and, meeting only weak outposts, had advanced as far as Sidi Barrani. A sudden attack by British Empire troops under General Wavell sent the Italians flying. The British now invaded Libya.

The Germans had to come to the rescue of the Italians. With Nazi help Italy managed to stop the British advance in Libya in 1941. But she lost all her East African possessions, including Ethiopia, to British Empire troops. In the meantime Germany had continued her conquests.

On April 5, 1941, she declared war on Yugoslavia and Greece. Yugoslavia, fighting alone against the German and Italian armies, had to give up the fight after twelve days. Greece was aided by a comparatively small body of British troops, and she held out a little longer. By the end of April, however, the entire Greek mainland was in the hands of the Germans and Italians.

By this time the Berlin-Rome Axis had added other partners: Bulgaria, Rumania, Slovakia and Hungary. There seemed to be no stopping the Nazis and their allies. Vichy-held Syria, at the eastern end of the Mediterranean Sea, seemed likely to be the next Axis victim. For once, the British decided to act beforehand. An army made up of British Empire and Free French troops invaded Syria on June 8, 1941, and occupied it after a brief campaign.

On June 22, 1941, the world was stunned to hear that the Germans had launched a sudden attack on Russia. Aided by some of their Axis allies and by Finland, the Germans were everywhere successful at first; they conquered a large part of European Russia. The Russian armies made a stand at last on a line extending roughly from Leningrad in the north to Moscow in the center and Rostov in the south. Despite heavy losses, the Russians were far from beaten. In November, 1941, they began a counter-offensive which won back some of the lost territory.

Thus far the United States had remained neutral. The American government, however, made no secret of its sympathy with the Allies. After Germany's attack on the

Official photo, British Press Service

A camel patrol, attached to one of Britain's Indian brigades, holding an advanced post on the Eritrean border.

neutral states of Luxemburg, Holland and Belgium in May, 1940, the United States began to re-arm; and she made it clear that the purpose of this move was to defend herself against the Axis. In September, 1940, America adopted the first peacetime conscription measure in her history.

In the same month President Roosevelt transferred fifty over-age destroyers to Great Britain in exchange for eight bases on British territory in the New World. These destroyers helped greatly in fighting Germany's U-boats. America took an even more effective step against the Axis in March, 1941, when Congress passed the Lend-Lease Act. This measure aided Great Britain and the other powers fighting the Axis in getting supplies from the United States. Other acts directed against the Germans and the Italians followed in quick succession. This policy seemed bound to lead to war against the Axis sooner or later.

Relations with Japan also became strained. Japan was still fighting the stubborn Chinese, who, like the British, would not accept defeat. But for all her heroism, China could not prevent the Japanese from occupying most of her coastal areas. The ambitious Japanese now began to penetrate farther and farther to the south. They forced Thailand

Acme

American troops landing at Mers-El-Kebir, near Oran, Algeria, in the African invasion of November, 1942.

(Siam) to enter an alliance with them; they set up military bases in Indio-China, which was a Vichy-French possession.

Americans were alarmed at these moves. They could not help recalling that in September, 1940, Japan had signed a pact with Germany and Italy. Was Japan going to join her allies in a war of world conquest? The United States now adopted a firm policy toward the Japanese. In so doing, she had the backing of Great Britain and the Netherlands, both of which had great possessions in the South Pacific.

And then Japan struck without warning. On December 7, 1941, Japanese carrier-based planes attacked the American naval base of Pearl Harbor, in the Hawaiian Islands, and caused heavy damage. At about the same time the Japanese struck at the Philippines, Guam, Midway and Wake. They also attacked various British possessions in the Far East, including Hong Kong and Malaya. Germany and Italy joined Japan in declaring war on the United States.

The United States hastily mustered its forces, but the Japanese had things all their own way at first. They occupied vast areas belonging to the United States, Great Britain and the Netherlands—the Philippines, Wake and Guam, Malaya, the Dutch East Indies, Burma, the northern part of New Guinea. Australia was threatened by the steady Japanese advance.

THE JAPANESE WAR MACHINE IS CHECKED AT LAST IN THE BATTLE OF THE CORAL SEA

In May, 1942, Japan was checked at the Battle of the Coral Sea, south of New Guinea. In June a great Japanese invasion fleet was turned back by American carrier-based and land-based planes near American-held Midway Island. United States forces took the offensive on a rather modest scale in August, 1942, when they invaded Guadalcanal and several other islands of the Solomon group. The Japanese tried desperately to drive off the invaders, but in vain. In the meantime the Allies threw back a Japanese force attempting to reach Port Moresby, on the southern coast of New Guinea.

The war in northern Africa took a dramatic turn in 1942. In June the Axis armies under their German commander, Marshal Rommel, made a sudden attack upon the British positions in Libya. The British were routed. They retreated, with the Axis troops in close pursuit. until they reached El Alamein, only seventy miles from Alexandria, Egypt. Here they held. In the following months the British built up their strength. In October they attacked in their turn and utterly defeated the Axis forces. There now began a British advance that carried deep into Libya by the end of the year.

While Rommel's troops were retreating toward the west, the entire Axis position in North Africa was endangered by a bold Allied move. A great Allied expeditionary force invaded French North and West Africa on November 8, 1942. The invaders, composed of American and British troops, soon occupied all of Morocco and Algeria. But before the Allies could seize Tunisia, to the east, the Axis had occupied that province. Now the Germans had cause to fear that the Allies would invade southern France from Africa. So the Nazis took over all of France. The French Government at Vichy was forced to obey German commands.

THE RUSSIANS MAKE A HEROIC STAND AT STALINGRAD, ON THE VOLGA RIVER

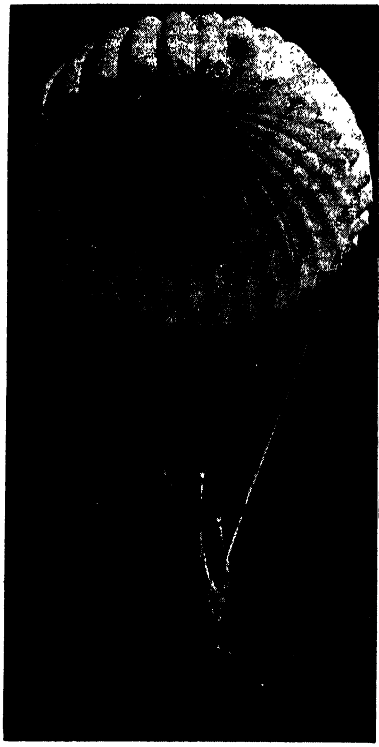
The warfare in Russia in 1942 presented much the same pattern as in 1941. In May the Germans attacked on a wide front and at first were successful almost everywhere. They advanced to the city of Stalingrad, on the Volga River, and also deep into the Caucasus. If Stalingrad had fallen, the Russian position would have been desperate indeed. But with magnificent courage the Russian troops held firm and at last the Axis attacks were halted all along the line. In November the Russians began an offensive of their own that forced a German retreat.

In 1942 Allied bombings of targets within Germany were more frequent and more effective than ever before. American bombers joined Britain's Royal Air Force in air raids on German targets. Hamburg, Essen, Cologne and other important cities that were manufacturing war goods took a heavy pounding from the air. German bases in occupied territory also felt the force of increased Allied air power.

The year 1943 saw all Africa cleared of the Axis foe. The Germans, with but little aid from the Italians, put up strong resistance in that area for a time. In March, 1943, however, the Allies began a series of attacks that steadily drove the enemy back. At last, on May 12, all the Axis soldiers left in northern Africa surrendered.

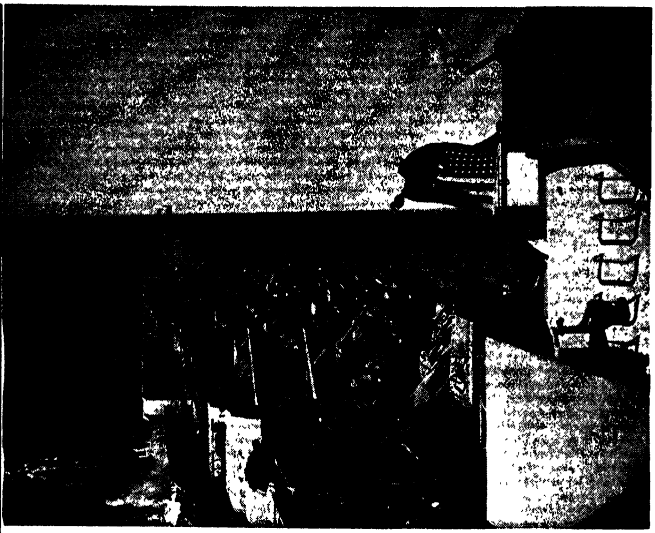
On July 10 the Allies invaded the Italian island of Sicily. As the war was thus brought home to the Italians, Mussolini became more and more unpopular. Finally, on July 25,

WORLD WAR II FIGHTERS AND EQUIPMENT



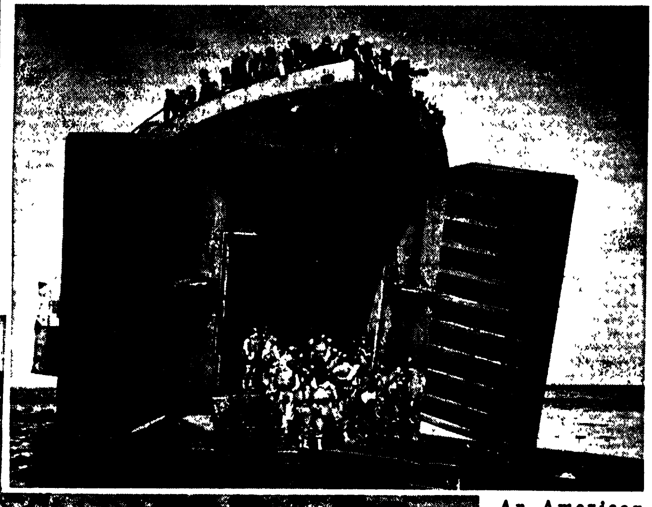
Official photo, U. S. Marine Corps

A paratrooper in action. German and Allied paratroopers were used in many areas in World War II. They played an important part in Allied successes in the later years of the war.

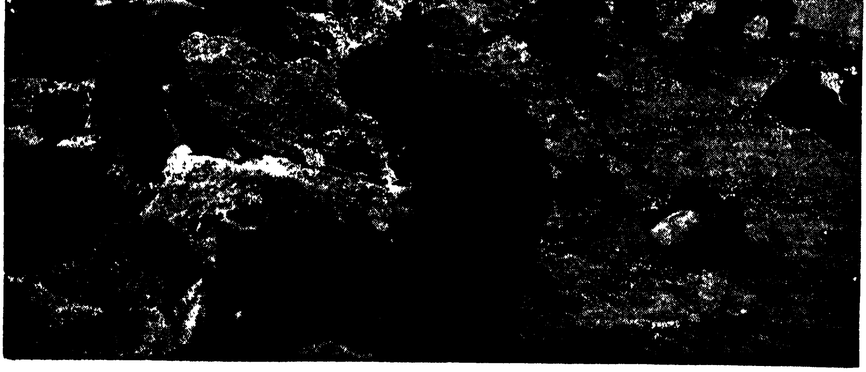


All pictures except upper left, Official U. S. Navy photos

Stowed on the deck of a Navy aircraft carrier, Curtiss "Helldivers" and Grumman "Hellcats" are ferried to a Pacific destination early in 1944. The aircraft carrier came into its own in World War II.



An American LST (Landing Ship — Tanks). LST's landed men, heavy tanks and trucks in many parts of the world.



Members of a U. S. Navy beach battalion dig in for their first night ashore on a beachhead on the French coast. The sailors "hit the beach" along with U. S. Army men.

1943, he was forced to resign. Marshal Pietro Badoglio became premier, but not dictator.

The change of government did not help the Italians very much. Sicily fell on August 17, 1943. Thereafter the Allies gave Italy no rest; they bombed her almost defenseless cities again and again. On September 2 they invaded the Italian mainland, crossing over from Sicily. Italy's resistance was quite broken by this time; on September 8 she surrendered unconditionally to the Allies.

German troops had been stationed in Italy for months and they had become the real masters of the country. They resisted stubbornly the advance of Allied troops. By the end of 1943 the Allies had conquered less than half of Italy; Rome, the capital, was still in the hands of the Germans.

The Russians freed vast areas of their country from German occupation in 1943. They broke the siege of Stalingrad, on the Volga River, and of Leningrad, in the north. They recaptured the great cities of Poltava, Smolensk and Kiev, among others.

In 1943 the Japanese began to lose their grip on their conquests in the South Pacific. They were forced to evacuate Guadalcanal Island in February. In the months that followed, they were steadily pushed back in New Guinea; American troops overran the islands of Tarawa and Makin, in the Gilbert group. In the meantime American warships, planes and submarines inflicted staggering losses on Japan's navy and her merchant ships.

The Russian war machine continued to advance in 1944 until well into the month of May. By that time almost all of western Russia had been freed from the Germans. The Russians had driven into Estonia, Latvia, Poland and the province of Bessarabia. They had entirely cleared the Crimea of the enemy.

There was little action in Italy during the early months of 1944. On May 12, 1944, the Allies launched a powerful offensive in the western section of the Italian front. The Germans retreated, and Rome fell on June 4. The Allies now advanced all along the line in Italy.

On June 6, two days after the fall of Rome, a mighty expedition of 200,000 American and British Empire troops (including many Canadians) invaded the French province of Normandy. The Germans fought fiercely, but they had practically no air support, for British and American planes ruled the skies. In a few weeks the Normandy peninsula was firmly in the hands of the Allies.

For a time the British and Americans were shut up in the peninsula. Yet never did they ease their pressure, and at last the German lines began to crack. Toward the end of July, the Americans broke out from Normandy. One column overran the neighboring province of Brittany; another set off in the direction of Paris. To add to the troubles of the Germans, British and American troops invaded southern France, between Marseilles and Nice, on August 15. As the Allies in the north pushed on toward Paris, the southern expeditionary force made its way northward. The Germans began a rapid retreat.

This retreat did not come to an end until the end of September. By that time almost all of France (including Paris), Belgium and Luxemburg had been freed from the foe: Allied troops had begun the invasion of Ger-

U. S. Marine Corps photo

U. S. marines in their camouflaged battle dress on a beach in the Southwest Pacific.

Official U. S. Navy photo

The mighty U. S. S. Missouri in her camouflage paint. The official surrender of the Japanese took place on the deck of the Missouri in September, 1945.

Official U. S. Marine Corps photo

A Marine Corsair fighter looses its load of rocket shells on a run against a Japanese stronghold on Okinawa.

many. In the months that followed Allied advances were slow, for at a number of points the Allies had come up to Germany's powerful Siegfried Line. Yet in spite of stiffened German resistance more and more territory fell into the hands of the Allies, including the cities of Cologne and Aachen.

Suddenly on December 16, 1944, the Germans began a violent counter-offensive along a weakly held part of the Allied line near the Belgian border. The American troops who manned this part of the front were taken completely by surprise. The Germans advanced through the wilderness of the Ardenne Forest deep into Belgium; they threatened to break into northern France. The Allies managed to stop this drive at last, but only with the greatest difficulty.

On the eastern front the Russians had begun another offensive in June, 1944. By the end of the year the Red Army had achieved amazing results. Russia had forced the surrender of three of Germany's allies—Rumania, Bulgaria and Finland—and had made them turn their weapons against the Axis. She had battered Hungary badly. All of Russia had been freed from the enemy. The Russians had penetrated deeply into Poland, Czechoslovakia and Yugoslavia.

Russian successes in Yugoslavia brought about the liberation of Greece. The line of communication of the German troops in Greece ran through Yugoslavia and that line was now endangered. The Germans, therefore, determined to retreat from Greece while there was still time. As they moved out, British troops from the Middle East moved

Acme

A robot bomb about to crash in a town in southwestern England.

British Information Services

Men of the British Royal Air Force examining a robot bomb which has just been shot down.

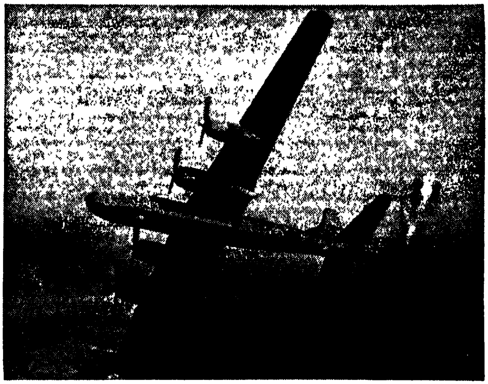
in. On November 4, 1944, the last German soldiers left Greece.

Germany continued to be pounded from the air by the British and Americans. The Germans fought back in 1944 with increasing effectiveness. In June they began an attack on targets in England by robot bombs —pilotless, jet-propelled planes, each carrying a ton of high explosive. Fearful damage was done by the V-1, as the robot bomb was called. (V stands for the German word *Vergeltungswaffen,* or vengeance weapon.)

Later the Germans used another deadly projectile. This was the V-2, a huge rocket, carrying high explosive, which soared seventy miles or so into the upper air and which then plunged downward toward its target at a speed greater than that of sound. The V-1 and V-2 were used against targets in the liberated countries as well as in England.

The war against Japan in 1944 went well, on the whole. American troops invaded some of the eastern island outposts of the Japanese Empire. Before the end of the year most of the Marshall and Marianas islands were in their possession and they had won a foothold on the Caroline Islands. In October an American expedition landed on Leyte Island, in the Philippines. In the months that followed the Americans drove the Japanese from one Philippine stronghold after another.

In June, 1944, the Japanese main islands first felt the hitting power of America's giant bombers, the B-29 Superfortresses. In the months that followed, large fleets of Superfortresses, flying from bases in the Marianas, dropped hundreds of tons of high explosives and fire bombs. Tokyo, Yokohama, Osaki and other cities were badly smashed.

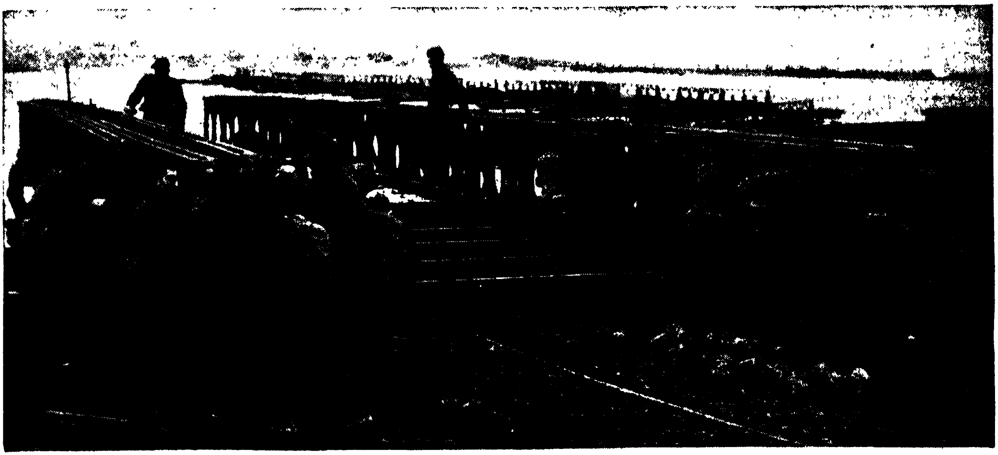


Boeing Aircraft Co.

The mighty B-29 Superfortress in full flight.

The Japanese did not remain on the defensive throughout 1944. In March they invaded British India from Burma and for a time they endangered the state of Manipur. But at last they were driven out of India, and Allied troops plunged deep into Burma in pursuit of the retreating enemy. The Japanese were more successful in China. Their invasion columns, striking from the north and south, captured a number of cities and succeeded in cutting China in two.

As 1945 opened, German advance units were still deep in Belgium. The Allies brought up fresh reserves, and their overwhelming air power made itself felt. By the middle of January the Germans were fleeing eastward to the shelter of the Siegfried Line



Canadian Army photo

Royal Canadian engineers building a bridge which is to span the Rhine River, in Germany. Here they are shown sliding a section into place. The Rhine did not prove to be so formidable an obstacle as the Allies had feared.

under the concentrated fire of the Allies.

The Allies pressed the attack on Germany from the west. By the first week in March several armies had reached the west bank of the Rhine River. On March 8 an American force crossed the river over the Hindenburg Bridge at Remagen—a bridge that a careless German officer had failed to blow up. The Nazis rushed up reserves in order to drive the Americans back; in doing so, they weakened other parts of their line. Several new crossings of the river now took place. By the end of March, Allied columns had driven far beyond the Rhine.

In the meantime the Russian steam roller had ground ahead steadily in the east. The Russians forced Hungary, Germany's last ally, to sign an armistice. They invaded the German provinces of East Prussia and Silesia. By April the Russians had reached the mouth of the Oder River; they had driven deep into Silesia; they had marched across western Hungary and stood at the Austrian border. Austria was now doomed.

In April, 1945, Germany was shattered by mighty blows from the east, west and south. The Russians crossed into Austria and captured Vienna on April 13. A week later they fought their way into the heart of Berlin. In the west American tanks reached the Elbe River, only seventy miles west of Berlin. One big German city after another —Hanover, Weimar, Leipzig, Stuttgart, Bremen, Munich—fell to the American, British and French invaders. In Italy the Germans were driven out of Verona, Genoa, Milan and Venice.

On May 1 the German radio at Hamburg solemnly announced the death of Adolf Hitler. Many people refused to believe this report. It was rumored that he had fled to a foreign land, leaving his people to their fate. It really did not matter whether he was alive or dead, for the end of nazi Germany was at hand.

On May 2 the Germans in northern Italy

Both photos, U. S. Signal Corps

The unconditional surrender of Germany to the Allies is recorded at Reims, France, in May, 1945. Nazi Chief of Staff Gustaf Jodl (center) puts his signature on the official document.

General of the Army Douglas MacArthur signs as the Supreme Allied Commander during the formal Japanese surrender ceremonies which took place on the U. S. S. Missouri in September, 1945.

and southern Austria—a total of a million men—gave up the fight. Two days later the British accepted the surrender of the German troops in northwestern Germany, Denmark, Helgoland and the Frisian Islands. On May 8, Admiral Doenitz, who claimed that he had become ruler of Germany on the death of Hitler, signed the terms of final surrender, officially ending resistance throughout Germany. V-E Day—the day of victory in Europe—had come at last.

With the war in Europe at an end, the Allies were free to turn their entire might against Japan. The early months of 1945 had seen the Japanese reeling under heavy blows. The British had reconquered Burma, after a difficult campaign in dense jungle country. Australian troops had invaded the huge island of Borneo. American forces had captured Iwo Island and had invaded Okinawa, in the Ryukyu group. Only a few scattered groups of Japanese were still holding out in the Philippines. Japan's once mighty navy had been driven from the seas. American bombers had kept pounding away at the Japanese homeland.

By V-E Day Japan was already a beaten country. She had failed miserably in her effort to strike terror on the American mainland by means of pilotless paper balloons, carrying bombs. She had caused much more damage with her "suicide planes," which were sent crashing by their pilots into American bombers and warships, but these suicide planes had not prevented the Americans from driving ahead steadily. The question now was: how long would Japan, a beaten enemy, keep up the hopeless struggle?

On August 5, 1945, the United States loosed a terrible new weapon upon the Japanese. An American Superfortress dropped a single atomic bomb upon the city of Hiroshima. The explosion, caused by the smashing of uranium atoms, caused fearful damage. An area of over four square miles was flattened out by this one bomb; more than 100,000 persons lost their lives.

THE FIRST ATOMIC BOMB IN THE HISTORY OF WARFARE SHATTERS HIROSHIMA

August 8, 1945, was a black day in Japanese history. On that day another atomic bomb was dropped—this time on Nagasaki. On that day, too, Russia declared war on Japan and at once attacked the Japanese positions in Manchukuo. The Japanese now realized that further resistance was hopeless. On August 10 they offered to surrender; they asked only that their emperor, Hirohito, should be left on the throne of Japan.

The Allies agreed to let the Emperor remain; but they made it clear that this monarch was to be a mere puppet, acting under the orders of the Allied supreme commander. On the 14th the Japanese accepted these terms. The official surrender took place on the deck of the battleship Missouri in Tokyo Bay on September 1, 1945, United States time. This corresponded to September 2, Tokyo time; and September 2 was proclaimed as V-J Day—the day of victory over Japan. World War II was over at last, six years after it began.

WORLD WAR II SEES THE DESTRUCTIVE ART OF WARFARE DEVELOPED AS NEVER BEFORE

World War I had been the bloodiest in the history of mankind. World War II was more destructive in every way. More nations took part; more lives were lost; damage to property was greater; there were more homeless people as a result. Land warfare had become more deadly than ever with the perfection of the tank, the land mine and the flame thrower and the development of rocket-firing guns. Terrible blows had been dealt from the air. The air raids of the first world war were insignificant compared to those of the second. To add to the horrors of the war in the air there were Germany's V-1 and V-2—the pilotless jet-propelled plane and the high-soaring rocket.

But the deadliest weapon of all—one that made the others seem like childish toys—was the atomic bomb. Two thousand big bombers, each dropping ten tons of high explosive, would not have caused as much damage as the atomic bomb that dropped on Hiroshima. But this bomb was a crude affair, compared with the second one that struck Nagasaki only three days later. Would there be any limit to the destructiveness of the atomic bomb in days to come?

It was now clear as never before—clearer even than after World War I—that the countries of the world must unite to outlaw war and to insure peace. The nations fighting the Axis had realized this fact while the grim struggle against the foe was still going on. On June 26, 1945, they had signed a charter establishing a new league of nations —the United Nations Organization. (See the article on the United Nations.) Upon its success will depend the happiness of mankind and the very existence of our civilization in the years that lie ahead. See the Table of Important Events which follows.

THE NEXT STORY OF ALL COUNTRIES IS ON PAGE 6479.

IMPORTANT EVENTS: 1914-1945

EVENTS LEADING UP TO WORLD WAR I

1914

June 28. Archduke Franz Ferdinand and wife are assassinated at Sarajevo, Bosnia.

July 23. Austria sends ultimatum to Serbia.

WORLD WAR I

1914

July 28. Austria declares war on Serbia.

Aug. 1. Germany declares war on Russia.

Aug. 3. Germany declares war on France; invades Belgium.

Aug. 4. Great Britain declares war on Germany.

Aug. 20. Germans enter Brussels, Belgium.

Aug. 26-30. Germans defeat Russians at Tannenberg.

Sept. 5-9. Allies win First Battle of Marne.

Oct. 30. Russia declares war on Turkey.

Nov. 1. British squadron is defeated off Coronel, Chile.

Dec. 8. German fleet is defeated off Falkland Islands.

1915

Feb. 17. Germans announce blockade of British Isles; unrestricted submarine warfare begins.

Feb. 19. Allies bombard Dardanelles forts.

Apr. 22. Germans use poisonous gas for first time in attack on Ypres.

Apr. 25. Allies land on Gallipoli Peninsula.

May 7. British liner Lusitania is sunk by German submarine; 124 Americans are among victims.

May 23. Italy declares war on Austria.

Oct. 5. Allies land troops at Salonika; Bulgaria enters war on side of Central Powers.

Nov. 23. Serbia is overrun; Serbian army retreats into Albania.

1916

Jan. 8. British evacuate Gallipoli.

Feb. 21. Germans begin attack on Verdun.

May 31. Germans and British fight great naval battle off Jutland; neither is victor.

July 1. Allies begin Somme offensive.

Aug. 27. Rumania declares war on Austria-Hungary.

Dec. 6. Bucharest, Rumania, falls to Central Powers.

1917

Jan. 31. Germany announces she will renew unrestricted submarine warfare.

Feb. 3. United States breaks diplomatic relations with Germany.

Mar. 15. Nicholas II, tsar of Russia, abdicates. A provisional government is set up.

Apr. 6. United States declares war on Germany.

July 22. Greece declares war on Central Powers.

Oct. 24. Austrians and Germans rout Italians at Caporetto.

Nov. 7. Bolshevists overthrow provisional Russian authorities; establish communist government.

1918

Mar. 3. Russians sign peace treaty with Central Powers at Brest Litovsk.

Mar. 21. Germans drive back British near Amiens and Ypres.

Apr. 14. Ferdinand Foch becomes commander-in-chief of Allied armies in the west.

May 27. Germans launch successful attack against French forces along Aisne River.

July 15-Aug. 2. Allies win Second Battle of Marne.

Sept. 29. Bulgaria surrenders to Allies.

Oct. 31. Turkey surrenders to Allies.

Nov. 3. Austria surrenders to Allies.

Nov. 11. Germans sign armistice, ending war.

EVENTS BETWEEN WARS

1919

Jan. 18. Peace Conference opens at Versailles.

June 28. Treaty of Versailles is signed.

Nov. 19. United States Senate rejects Treaty of Versailles.

1920

Jan. 10. League of Nations holds first official session at Geneva, Switzerland.

1921

Aug. 25. Treaty of peace between United States and Germany is signed at Berlin.

1922

Feb. 6. Limitation of Armaments Conference at Washington comes to end. Five great powers agree to limit size and number of battleships.

Oct. 24. Fascists march on Rome; as a result a dictatorship is set up under Mussolini.

1923

Mar. 19. Revolt in Munich, Germany, is crushed; Adolf Hitler, one of the revolutionaries, is jailed.

1925

Nov. 27. Germany ratifies Locarno treaties.

1926

Sept. 8. Germany enters League of Nations.

1929

July 24. Kellogg Peace Pact goes into effect.

1931

Apr. 14. Alfonso XIII of Spain flees from Madrid; a republican government is set up in Spain.

Sept. 18. Japanese occupy Mukden, Manchuria.

1933

Jan. 30. Nazis take power in Germany when Hitler is named chancellor.

Oct. 14. Germany leaves League of Nations.

1934

June 30. Plot to overthrow Hitler Government in Germany is followed by "blood purge," that is, the murder of hundreds suspected of being unfriendly to Hitler.

1935

Jan. 13. People of the Saar vote to return to German sovereignty.

Mar. 16. Hitler announces he will establish army of 500,000, thereby violating Treaty of Versailles.

Oct. 3. Italians invade Ethiopia.

Nov. 18. Economic sanctions against Italy go into effect.

1936

Mar. 7. German troops enter Rhineland, in violation of Treaty of Versailles.

July 17. Revolt against Spanish republican government begins in Morocco.

Oct. 25. Berlin-Rome Axis is formed.

1937

July 7. Chinese and Japanese soldiers clash at Marco Polo Bridge, at Peiping; this brings on undeclared war between China and Japan.

1938

Mar. 13. Austria is annexed to German Reich.

Sept. 29. Munich Pact gives Germany part of Czechoslovakia.

1939

Mar. 15. Germans march into Czechoslovakia, which loses its independence.

Mar. 28. Spanish rebels occupy Madrid, ending Loyalist resistance.

Apr. 7. Italians invade Albania.

Aug. 23. Russia and Germany sign nonaggression pact.

WORLD WAR II

1939

Sept. 1. Germany invades Poland.

Sept. 3. Great Britain and France declare war on Germany.

Sept. 16. Russia invades Poland.

Sept. 29. Russia and Germany sign treaty, dividing Poland between them.

Nov. 30. Russia invades Finland.

1940

Mar. 12. Finland and Russia sign peace treaty.

Apr. 9. Germany invades Norway and Denmark.

May 10. Germany invades Belgium, the Netherlands and Luxemburg. — Winston Churchill becomes prime minister of Great Britain.

June 10. Italy declares war on France and Great Britain.

June 22. France signs armistice.

July 14. Russia annexes Estonia, Latvia and Lithuania.

Sept. 15. British Royal Air Force downs 187 German bombers in one day over England.

Oct. 28. Italy begins war on Greece.

1941

March 11. President Roosevelt signs Lend-Lease Act.

Apr. 5. Germany declares war on Yugoslavia and Greece.

Apr. 17. Yugoslavia surrenders to Axis.

Apr. 30. All of Greek mainland is occupied by Axis.

June 8. British and Free French invade Vichy-held Syria.

June 22. Germany invades Russia.

July 29. Vichy France permits Japan to occupy bases in French Indo-China.

Aug. 14. President Roosevelt and Prime Minister Churchill sign the "Atlantic Charter."

Sept. 20. Germans capture Kiev, Russia.

Dec. 7. Japan attacks Pearl Harbor, Philippines and other Pacific areas; then declares war on the United States and Great Britain.

Dec. 11. Germany and Italy declare war on United States.

1942

Feb. 15. Singapore, British base at tip of Malayan Peninsula, surrenders to Japanese.

Mar. 9. Japanese capture Rangoon, Burma.

Apr. 18. American planes raid Tokyo, Nagoya, Yokohama and Kobe.

May 6. Corregidor and other fortresses in Manila Bay surrender, ending organized American resistance in Philippines area.

May 8. Japanese are defeated in Battle of Coral Sea.

June 4. Battle of Midway begins. Japanese invasion fleet is turned back after three days of fighting.

July 4. British check Axis advance at El Alamein, seventy miles west of Alexandria, Egypt.

Aug. 7. United States troops invade Guadalcanal and other islands in Solomons group.
Sept. 7. Germans attack Stalingrad.
Nov. 4. Axis forces in Egypt are routed.
Nov. 8. Allied expeditionary force lands on French North and West Africa.
Nov. 11. Nazis begin taking over unoccupied France.

1943

Feb. 2. Russians put end to German resistance before Stalingrad.
Feb. 9. Japanese evacuate Guadalcanal Island.
Mar. 3. Allies score great victory over Japanese in Battle of Bismarck Sea.
May 12. All Axis troops left in North Africa surrender to Allies.
July 10. Allied troops invade Sicily.
July 25. Premier Mussolini of Italy is forced to resign; is replaced by Marshal Badoglio.
Aug. 17. Allies occupy all of Sicily.
Sept. 2. British invade Italian mainland.
Sept. 8. Italy surrenders.
Oct. 12. Great Britain sets up base in Azores Islands by agreement with Portugal.
Nov. 21. Americans land on Makin and Tarawa, islands of Gilbert group.

1944

Feb. 1. Americans invade Kwajalein Atoll, in Marshall Islands.
Mar. 22. Japanese invade Manipur State, India.
Apr. 10. Russians recapture Odessa.
June 4. Allies capture Rome.
June 6. Allies invade Normandy, France.
June 14. Americans invade Saipan Island, in Marianas.
June 15. Robot-bomb attack on southern England begins.
Aug. 15. Allied expedition invades southern France.
Aug. 17. Japanese invaders of India are driven back into Burma.
Aug. 23. Rumania goes over to Allies.
Aug. 25. Allies occupy Paris.
Sept. 4. British take Brussels and Antwerp, Belgium, and invade Holland.
Sept. 8. Bulgaria goes over to Allies.
Sept. 14. Americans invade Peleliu Island, in Carolines.
Sept. 19. Finns sign armistice with Russia.
Oct. 20. Americans invade Leyte Island, in Philippines.
Nov. 14. Last German soldiers withdraw from Greece.
Nov. 16. Six Allied armies hit Germans in west.
Dec. 16. Germans launch big counter-offensive in west.
Dec. 28. German offensive is checked at Celles.

1945

Jan. 20. Hungary signs armistice with Allies.
Mar. 8. Americans cross Rhine at Remagen.
Mar. 20. British take Mandalay, Burma.
Apr. 12. President Roosevelt dies; is succeeded by President Truman.
Apr. 13. Russians capture Vienna.
May 2. Germans in Italy and southern Austria give up.
May 4. Germans in Netherlands, Denmark and northwestern Germany surrender.
May 8. V-E Day; Germany officially surrenders.
June 11. Australians invade Borneo.
June 26. Charter of United Nations Organization is signed at San Francisco.
July 26. Clement Attlee replaces Churchill as prime minster of Great Britain.
Aug. 5. Atomic bomb smashes Hiroshima, Japan.
Aug. 8. Second atomic bomb hits Nagasaki. —Russia declares war on Japan.
Aug. 14. Japan accepts surrender terms; fighting stops.
Sept. 1. V-J Day: Japan signs official surrender terms on battleship Missouri, in Tokyo Bay.

Press Association

U. S. Marines raise the American flag on the summit of Mount Suribachi on Iwo Island, in the Volcano group (February, 1945). The Americans captured the island after a month of heavy fighting, in which American losses in killed and wounded totaled 20,000.

This remarkable picture was taken by a photographer of the Press Association who accompanied the marines, under heavy fire, to the summit of Mount Suribachi. Most of the members of the group shown here were killed or wounded not long afterward.

LITERATURE

Gramstorff Bros.

THE ROMANCE *of* WORDS

SOME music can make us feel sad; other music makes us feel like laughing and dancing; and there are tunes that turn men's thoughts to deeds of warfare and dreams of glory. If sounds played on an instrument can have these effects, how much more powerful in our lives are words, which have both sound and meaning. Truly, words are magical. They are the bricks and mortar of human speech; and many words in daily use have strange, romantic stories to tell. In this article we shall discuss some of the curious facts about words.

In the chapter on Feudal Times you read that our word "chivalry" comes from the French word *cheval,* a horse. The knights in armor of the Middle Ages fought on horseback. They were bound by oath to help the weak, especially women and children, and to be mannerly and gentle in peacetimes, however fierce they might be in war. They became known as "those on horseback," chevaliers, and their gentle manners were said to be chivalrous, that is, worthy of chevaliers. Now the word chivalry carries the idea of kindly courtesy. We have forgotten all about the horse!

From the Latin *caper,* a goat, we have the verb "to caper," that is, to jump about in a frolicsome manner, like a goat, and from the same root comes our capricious, meaning changing one's mind on a sudden whim, as a wild goat seems to do, as he jumps and turns and jumps again without reason.

"Sincere" is thought by some students to have come from the Latin *sine cera,* without wax, referring to a clean jar, without any remains of the wax that sealed it in a previous use, that is, of course, without wax or any other impurity. This derivation is still in question, however.

You may hear an idea described as chimerical. That means it is vague or unworthy of being taken seriously. The ancient Greeks believed in a monster, part lion, part goat and part serpent, breathing fire. They called it a chimera. When people learned that there was no such animal, they called any unreal or imaginary thing a chimera.

Most words of our common speech can be

taken apart and studied, and some of them can be traced back for hundreds of years, through many journeys, and through changes of spelling and of pronunciation and even sometimes of meaning. For instance, "impertinent," which used to mean wandering from the point, now describes a rudeness of manner. Tracing the life-history of words used to be a thrilling game for scholars, with all the excitements of a treasure hunt. Often false clues led them in wrong directions, but they kept on until now most of the words we use have their "family trees" carefully mapped out.

THE ENGLISH LANGUAGE IS A CURIOUS HODGE-PODGE OF MANY TONGUES

Yes, words do belong to family groups. There are something over a dozen language groups, of which ours is the most important. It is called the Indo-European or Indo-Germanic family, and includes English, German, Dutch, most of the Scandinavian tongues, Celtic languages like Gaelic and Welsh, Greek, Latin and the modern Romance languages which are founded on Latin: Italian, French, Spanish, Portuguese and Rumanian.

The ancient Sanskrit is considered one of the most beautiful and perfect languages of the Indo-European family. It is by comparison with Sanskrit that many words in other languages of the group are traced.

All of the languages in the Indo-Germanic group have certain family traits, and words are borrowed back and forth between them quite freely. Some of the family likenessess you may have noted for yourself, if you have any foreign friends. Our word "father" is *pater* in Latin and Greek, *vater* in German, in Dutch, *vader,* in Danish, *fader, père* in French, and *padre* in Spanish and Italian.

English is a curious blend of Latin, Norman-French, modern French and Germanic speech, with some old Celtic forms, on an Anglo-Saxon base. Perhaps for the very reason that it is a blend, it is one of the most interesting languages in the world today. It started in Celtic dialects not unlike those from which the present Welsh and the Gaelic now spoken in Ireland have developed. In 43 A.D. the Romans conquered most of Britain and for almost five hundred years Britain was a Roman colony. Latin was spoken, and gradually the Celtic speech all but disappeared in the towns, though traces remained, especially in the remote country sections where change is slow.

In the fifth and sixth centuries, however, Teutonic, that is, Germanic tribes—Angles, Saxons, Jutes, Danes and others from northern Europe—overran Britain. They probably came first to rob the prosperous coast towns, but the land was pleasing to them, so many stayed. The Teutonic language of the new conquerors in time became the common speech, but with many Celtic and Latin words stubbornly remaining. This Anglo-Saxon in turn became unfashionable when William the Conqueror brought his Norman barons and his Norman-French language to the land. All the same, though it was unfashionable, the Anglo-Saxon was too sturdy and useful to be killed. The country people refused to learn French. So the older language absorbed the new.

That is why we have such a mixture of words in our homes as: parlor, coming from the French; dining-room, a combination from French and Anglo-Saxon roots; kitchen and cellar and porch, which go back to the Latin; and piazza, borrowed from modern Italian. Parlor comes from *parler,* to talk. From this French root we also have parliament, parley, and parole, a spoken promise. Many of our words relating to food, dinner, supper, dessert and others are from France, perhaps because the French are excellent cooks. Entrée, hors d'oeuvres and demitasse we have taken from the French without change.

No wonder foreigners find difficulty in learning English! So many of its rules seem made only to be broken. Unfair is not fair; unhappy is not happy. But though we say uncouth and unkempt and ungainly, we no longer use couth, kempt and gainly. More puzzling still, uncanny is not the opposite of canny, but has a very special meaning of its own. Loose and unloose mean the same! Ravel and unravel also mean the same. Insane means not sane. But invaluable means very, very valuable.

A LANGUAGE IS A LIVING THING, CONSTANTLY GROWING BY ADDING NEW WORDS

English is alive, growing, ever changing, always on the watch for new color, new beauty and perfection of expression. Therefore it does not feel itself hampered by too many rules. In fact, so fast does it change that English of a few hundred years ago is not easily understood, as you can tell from the ballad, THE HUNTING OF THE CHEVIOT, on page 2901.

We make up words when we want or need them, usually going to Greek or Latin for new technical names: automobile, radio, telegraph, electron. In this connection the Germans sometimes follow a simpler method. They use the same compounds, but in German. Tele-phone mean distance-speaker. The German *Fernsprecher* is distance-speaker. The German *Kindergarten,* which we have borrowed, is another compound, children's garden, and a very pretty word.

We sometimes use people's names in making up new words, as in macadam, volt, boycott, lynch and sandwich. All are the names of people. Cabal is made from the initials of five men. We give place names to things, as calico, from Calicut, India, where this particular kind of cotton cloth was made. The kind of cloth we call damask gets its name from the city of Damascus.

After borrowing, English-speaking people follow no rule at all in putting a new word in service. Greek "phenomenon" we give a correct Greek plural, "phenomena." The French "beau," plural "beaux," is another example. But we take the Greek "drama" and give it an English plural, "dramas," and make an English adverb, "naïvely," out of

Gramstorff Bros., Malden, Mass.

Learning the alphabet is important because words you look up in the dictionary are always listed alphabetically.

the French "naïve" in common usage.

There are fashions in words. Slang words, especially, follow the fashions. When Shakespeare wanted to say "go away quickly," he used the phrases of his day, "get thee hence," or "avaunt!" Around 1900 boys and girls were saying "twenty-three, skiddoo!" Fifteen years later the command was "cheese it!" and in another twenty years the short, explosive "scram!" was in fashion. An occasional bit of slang adds spice to our conversation, but the person whose vocabulary is so poor that he must constantly use slang is a bore.

WORDS, LIKE PEOPLE, CAN EITHER GO UP OR DOWN IN THEIR FORTUNES

Not all words that have varying fortunes are slang. Sometimes a good word becomes debased, as "villain," which formerly denoted simply a farm worker; and "wench," which is now uncomplimentary, but once signified merely a pleasing young girl. A knave is a dishonest person. Formerly it meant, like the German *Knabe,* a boy. A scheme frequently implies slyness and even dishonesty. It comes from a good Greek root, *schema,* a plan. The suggestion of slyness has attached itself through centuries of use.

Other words go up in the world. Doctor Johnson considered "clever" a vulgar word, and a rather sloppy one. "To emulate" now means to pattern one's actions after a respected superior; formerly it carried the thought of malicious, mean envy.

It is not strange to find that poets love the meaning and the sounds of words. Homer delighted in heavy, sonorous, full-voiced words that rang against the ear like distant rumblings of war—*hekatombon,* for instance. Say it aloud and you will see that it is slow and heavy and dignified. Tennyson often chose singing little words, that trip easily from the tongue, and at the same time form a picture so that our eyes and ears are both pleased.

> "I come from haunts of coot and hern,
>   I make a sudden sally
> And sparkle out among the fern
>   To bicker down a valley."

Listen to Edgar Allan Poe:

> "Keeping time, time, time
>   In a sort of Runic rhyme
> To the tintinnabulation that so musically wells
> From the bells, bells, bells, bells,
>   Bells, bells, bells,
> From the jingling and the tinkling of the bells."

You may perhaps have a young friend who likes to hear himself using long words. There is no harm in this, if he uses them correctly. But we can speak with beauty and distinction without them. Coleridge says, in small and simple words:

> "The moving moon went up the sky
> And nowhere did abide:
> Softly she was going up
> And a star or two beside."

You, too, will find the beauty in words, if you look. You will find interesting stories, mysteries, jokes, tales of travel and adventure in words. The dictionary will be your guide. Use it with skill and you will be richly rewarded. Your writing and speaking will be clear and convincing, and when the time comes for you to learn another language of the Indo-European family you will approach it with confidence and master it with ease.

Possibly, however, you will some day want to learn a language from another family; Chinese, for instance. This will be more difficult. Chinese is one of the oldest languages in the world, but it has never lost its primitive formation. Where we have parts of speech, nouns, verbs, adverbs, adjectives and so on, that are differently formed, the Chinese use the same word for all parts of speech. The listener must be able to know from the surrounding words whether a verb or a noun is meant. They do not combine syllables into words, as "divisible" (able to be divided). Every word-idea is separate and usually is of one syllable only. It is necessary to learn thousands of word-ideas in order to speak the langauge with ease.

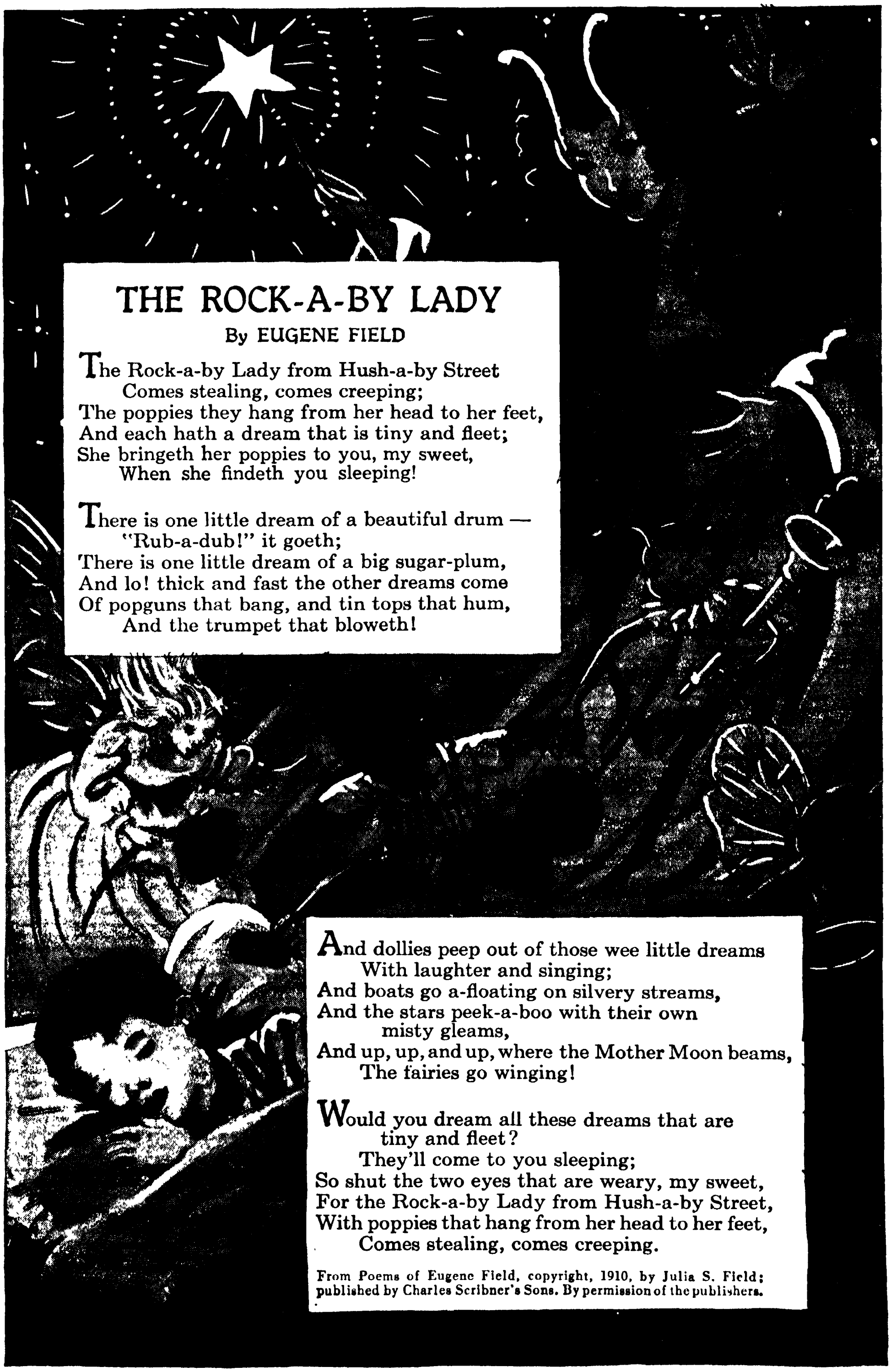
Another interesting fact about Chinese is that you say a certain word in a low tone and it means one thing; the same word in a high key means something else. Raising or lowering the voice at the end of the word also has meaning. Next time you hear two men from China holding a conversation, listen for the rising and falling tones. It is musical and very pleasant.

SOME DIALECTS, LIKE BASQUE, SEEM TO BE ORPHANS BELONGING TO NO FAMILY

In the northeast corner of Spain is a mysterious race, the Basques. Nobody knows their origin. Some think their forefathers may have lived on the fabled lost continent of Atlantis. The Basque tongue seems to be a member of no known language family.

Nor do the various dialects of the American Indians apparently belong to any large language family.

THE NEXT STORY OF LITERATURE IS ON PAGE 6559.



THE ROCK-A-BY LADY

By EUGENE FIELD

The Rock-a-by Lady from Hush-a-by Street
Comes stealing, comes creeping;
The poppies they hang from her head to her feet,
And each hath a dream that is tiny and fleet;
She bringeth her poppies to you, my sweet,
When she findeth you sleeping!

There is one little dream of a beautiful drum —
"Rub-a-dub!" it goeth;
There is one little dream of a big sugar-plum,
And lo! thick and fast the other dreams come
Of popguns that bang, and tin tops that hum,
And the trumpet that bloweth!

And dollies peep out of those wee little dreams
With laughter and singing;
And boats go a-floating on silvery streams,
And the stars peek-a-boo with their own misty gleams,
And up, up, and up, where the Mother Moon beams,
The fairies go winging!

Would you dream all these dreams that are tiny and fleet?
They'll come to you sleeping;
So shut the two eyes that are weary, my sweet,
For the Rock-a-by Lady from Hush-a-by Street,
With poppies that hang from her head to her feet,
Comes stealing, comes creeping.

From Poems of Eugene Field, copyright, 1910, by Julia S. Field; published by Charles Scribner's Sons. By permission of the publishers.

. . . A FROG HE WOULD A-WOOING GO,

A Frog he would a-wooing go,
Heigho! says Rowley.
Whether his mother would
let him or no;
**With a roley-poley, gammon and*
spinach.
Heigho! says Anthony Rowley.

So off he set in his opera hat,
Heigho! says Rowley.
And on the way he met with a Rat.

Pray, Mr. Rat, will you go with me?
Heigho! says Rowley.
Pretty Miss Mousey for to see?

They soon arrived at Mousey Hall,
Heigho! says Rowley.
They gave a loud knock and
gave a loud call.

Pray, Miss Mousey, are you within?
Heigho! says Rowley.
Oh, yes, kind sir. I'm sitting to spin.

---

*Repeat last two lines of first verse after each verse.

HEIGHO! SAYS ANTHONY ROWLEY . . .

Pray, Mr. Frog, will you give us a song?
Heigho! says Rowley.
But let it be something
that's not very long.

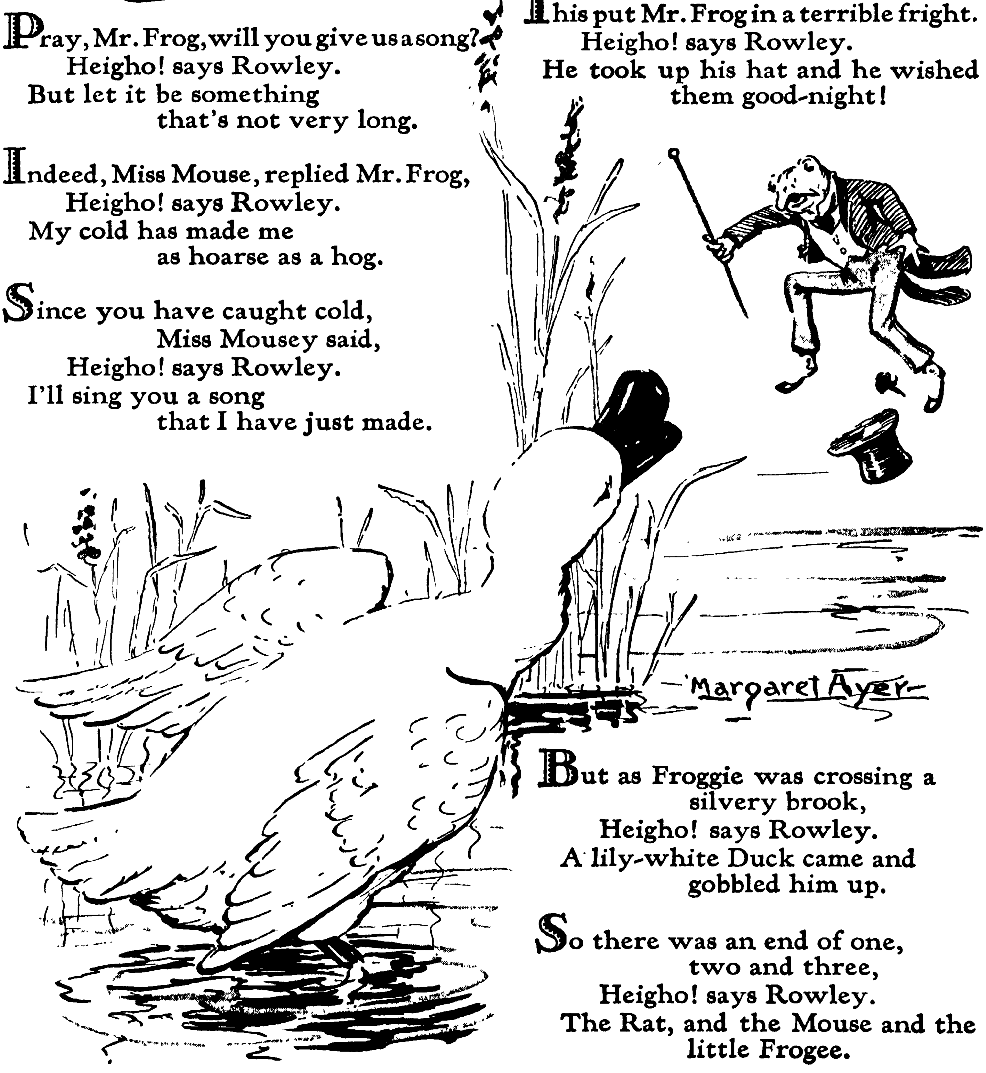
Indeed, Miss Mouse, replied Mr. Frog,
Heigho! says Rowley.
My cold has made me
as hoarse as a hog.

Since you have caught cold,
Miss Mousey said,
Heigho! says Rowley.
I'll sing you a song
that I have just made.

But while they were thus
a-merry-making,
Heigho! says Rowley.
A Cat and her Kittens
came tumbling in.

The Cat she seized the Rat
by the crown.
Heigho! says Rowley.
The Kittens they pulled
the little Mouse down.

This put Mr. Frog in a terrible fright.
Heigho! says Rowley.
He took up his hat and he wished
them good-night!



But as Froggie was crossing a
silvery brook,
Heigho! says Rowley.
A lily-white Duck came and
gobbled him up.

So there was an end of one,
two and three,
Heigho! says Rowley.
The Rat, and the Mouse and the
little Frogee.

ALL AROUND THE MULBERRY BUSH

Here we go round the mulberry bush,
mulberry bush, mulberry bush,
Here we go round the mulberry bush,
So early on Monday morning.

This is the way we wash our clothes,
wash our clothes, wash our clothes,
This is the way we wash our clothes,
So early on MONDAY morning.

Here we go round the mulberry bush,
mulberry bush, mulberry bush,
Here we go round the mulberry bush,
So early on Tuesday morning.

This is the way we iron our clothes,
iron our clothes, iron our clothes,
This is the way we iron our clothes,
So early on TUESDAY morning.

Here we go round the mulberry bush,
mulberry bush, mulberry bush,
Here we go round the mulberry bush,
So early on Wednesday morning.

This is the way we bake our pies,
bake our pies, bake our pies,
This is the way we bake our pies,
So early on WEDNESDAY morning.

Here we go round the mulberry bush,
mulberry bush, mulberry bush,
Here we go round the mulberry bush,
So early on Thursday morning.

This is the way we sweep our floors,
sweep our floors, sweep our floors,
This is the way we sweep our floors,
So early on THURSDAY morning.

Here we go round the mulberry bush,
mulberry bush, mulberry bush,
Here we go round the mulberry bush,
So early on Friday morning.

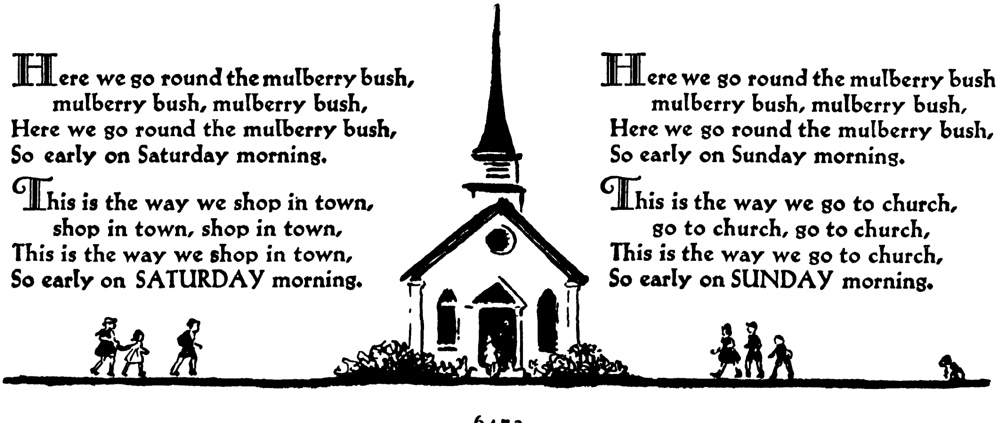
This is the way we sew and mend,
sew and mend, sew and mend,
This is the way we sew and mend,
So early on FRIDAY morning.

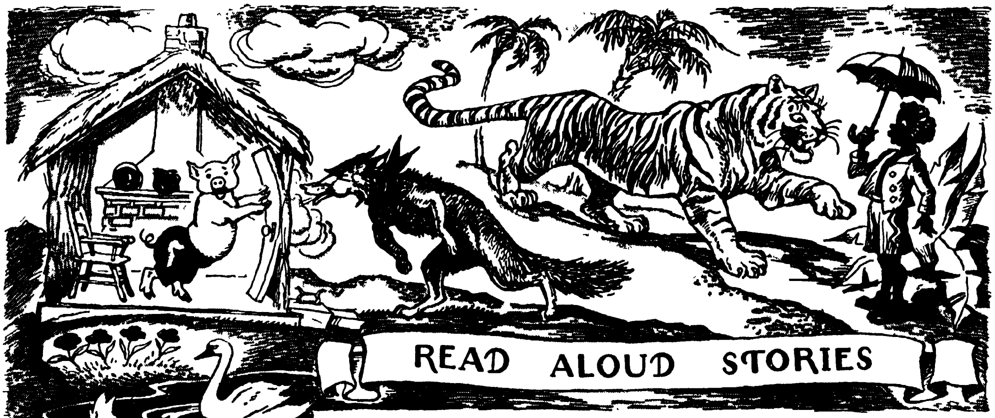
Here we go round the mulberry bush,
mulberry bush, mulberry bush,
Here we go round the mulberry bush,
So early on Saturday morning.

This is the way we shop in town,
shop in town, shop in town,
This is the way we shop in town,
So early on SATURDAY morning.

Here we go round the mulberry bush.
mulberry bush, mulberry bush,
Here we go round the mulberry bush,
So early on Sunday morning.

This is the way we go to church,
go to church, go to church,
This is the way we go to church,
So early on SUNDAY morning.





Little Red Riding-Hood

Little Red Riding Hood has been a story beloved by children for about three hundred years. It appeared in Charles Perrault's collection, Tales of Mother Goose, in 1697, and may have been written by him. The Brothers Grimm had a version of the story. Andrew Lang's Red Fairy Book contains a translation of a modern version by the French author Charles Marelles. The version below is by Ellen McLoughlin.

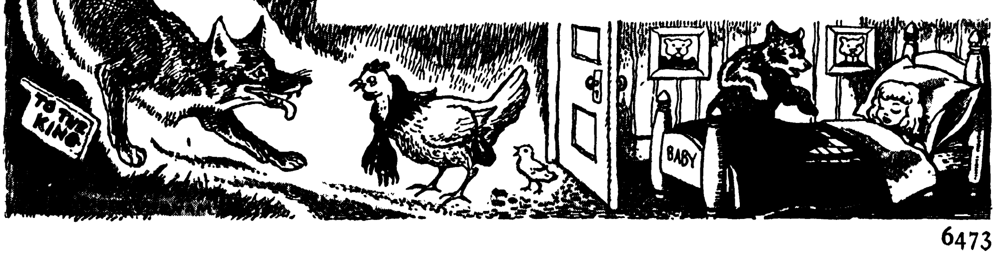
A LITTLE girl once lived in a small house at the edge of a forest. Her mother had made her a pretty and warm red cloak. It had a red hood to cover her curls, and she was so fond of the cloak that she wore it almost every day. So people called her Little Red Riding-Hood.

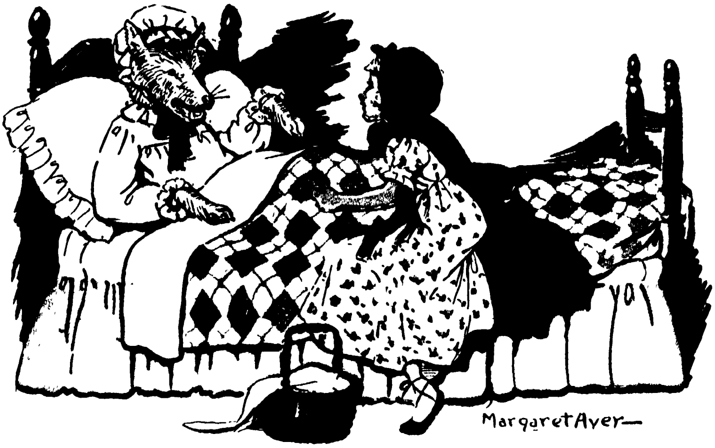
At the other side of the forest, near the road that went to town, was another small house and there Little Red Riding-Hood's grandmother lived, all alone.

One fine afternoon Little Red Riding-Hood's mother said: "Your grandmother is not very well. In this basket I have put some eggs and a jar of honey and some butter. Put on your cloak and take these dainties to her, with my love. But be sure that you do not dawdle on the way, because it will soon be dark, and then, you know, the wolves come out in the forest."

So Little Red Riding-Hood put on her red cloak and tied the red hood under her chin, and she took the basket with the eggs and the jar of honey and the butter, and away she went.

But the wild flowers were very beautiful in the wood, and she put down her basket on the stump of an old tree trunk, and began to pick the blossoms. Far off she could hear the





voices of the woodcutters and the sound of their axes chopping through the trees.

The little gray squirrels, with their furry tails, darted out from the bushes and ran up the trees, where the birds were singing among the leaves. And Little Red Riding-Hood forgot all about the wolves.

Soon it began to grow dark, and remembering what her mother had said, she jumped up, and was picking up her basket when who should come bounding up to her but a big gray wolf!

"Where are you going?" asked the wolf. He spoke so kindly in his gruff voice that Little Red Riding-Hood thought he could not possibly hurt her. So she told him she was carrying some eggs and a jar of honey and some butter to her grandmother, at the other side of the wood.

"Ah!" said the wolf, "I know where that is!" Away he ran and was soon out of sight.

The wolf ran very fast and did not stop until he came to the grandmother's small house at the edge of the forest, near the road to town. The wolf knocked at the door, and the grandmother called out in a weak voice: "Pull the bobbin and the latch will go up."

The wolf pulled the bobbin and the latch went up and he pushed open the door. He stole into the bedroom, where the old lady lay in bed, with a white nightdress and a lace cap on.

The wolf opened his great jaws to gobble her up, but the grandmother hopped out of the other side of the bed and ran out the back door of the house, and ran and ran, down the road that went to town, in her white nightdress and her lace cap.

The wolf went to the bureau, and he pulled open a bureau drawer and found one of grandmother's white nightgowns, and he put it on. Then he opened another bureau drawer and there he found one of grandmother's lace caps. And he put it on, and he jumped into bed and pulled the covers well up about him.

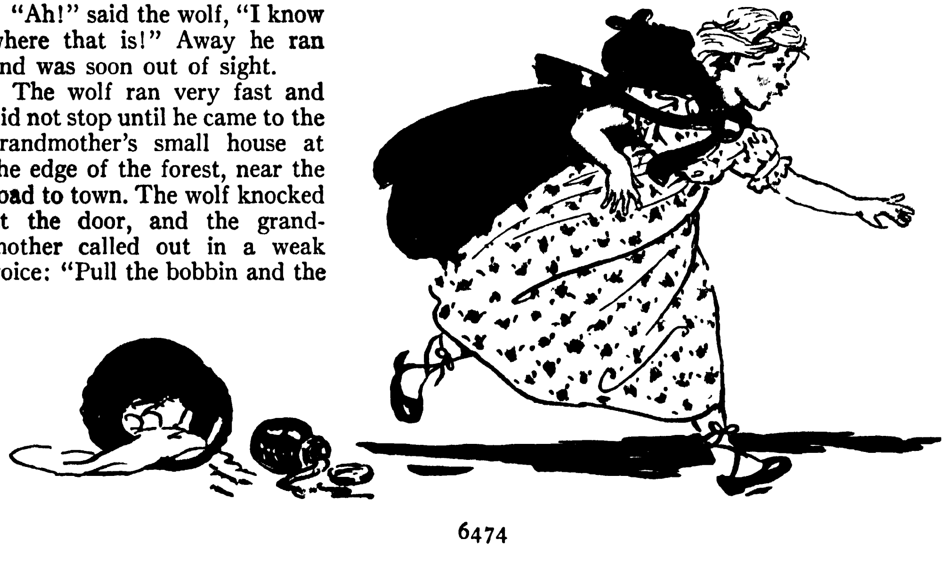
Soon there came a tap at the door.

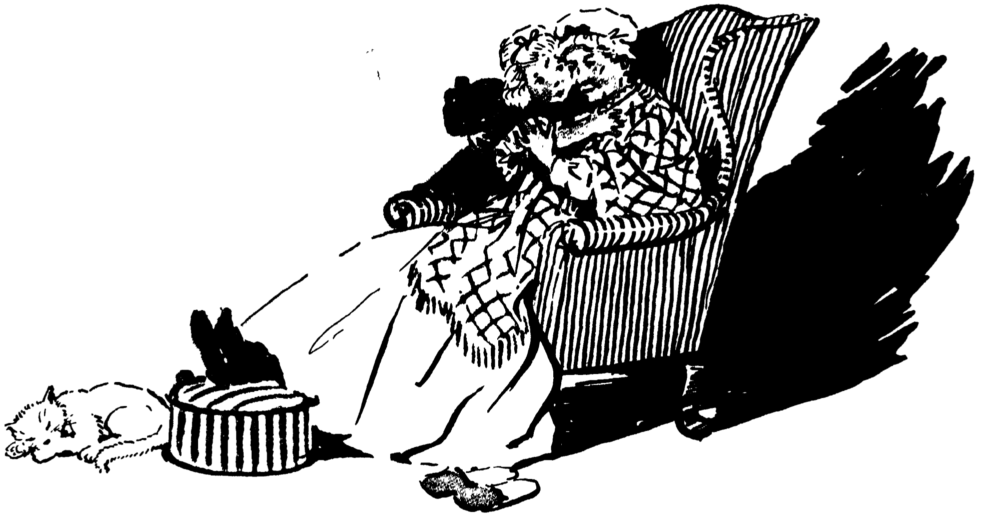
"Pull the bobbin and the latch will go up!" called the wolf in a weak voice.

"Why, you've got a cold, Granny," said Red Riding-Hood, coming in.

"Ahem! A little, my dear, a little," replied the wolf. "Shut the door well, my little lamb, then come and sit close beside me."

Little Red Riding-Hood sat down by the





side of the bed.

"I have brought you some eggs and a jar of honey and some butter," she said, as she bent over the bed. "But what great big ears you have, grandmother!"

"All the better to hear you with," said the wolf.

"What great big eyes you have, grandmother!"

"All the better to see you with, my child!"

"And, oh, what great big teeth you have, grandmother!"

"All the better to eat you with!" cried the wolf, and he jumped out of bed.

Little Red Riding-Hood ran screaming to the door, the wolf after her, his great jaws open. But just then two woodchoppers, brought by grandmother from the town, burst into the room and killed the wolf dead. Then the grandmother comforted Red Riding-Hood and fed her cake and honey, and the woodchoppers took her home, through the darkening forest. And she told the whole story to her mother.

The Cock, The Mouse and The Little Red Hen

An Old Tale Retold *by* Félicité Lefevre

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Once upon a time there was a hill, and on the hill there was a pretty little house. It had one little green door, and four little windows with green shutters, and in it there lived A COCK and A MOUSE and A LITTLE RED HEN.

On another hill close by there was another little house. It was very ugly. It had a door that wouldn't shut, and two broken windows, and all the paint was off the shutters. And in this house there lived A BOLD BAD FOX and FOUR BAD LITTLE FOXES.

One morning these four bad little Foxes came to the big bad Fox, and said:

"Oh, Father, we're so hungry!"

"We had nothing to eat yesterday," said one.

"And scarcely anything the day before," said another.

"And only half a chicken the day before that," said the third.

"And only two little ducks the day before that," said the fourth.

The big bad Fox shook his head for a long time, for he was thinking. At last he said in a big gruff voice:

"On the hill over there I see a house. And in that house there lives a Cock."

"And a Mouse," screamed two of the little Foxes.

"And a Little Red Hen," screamed the other two.

"And they are nice and fat," went on the big bad Fox. "This very day, I'll take my great sack, and I will go up that hill, and in that door, and into my sack I will put the Cock and the Mouse and the Little Red Hen."

"I'll make a fire to roast the Cock," said one little Fox, and he licked his chops.

"I'll put on the saucepan to boil the hen," said the second.

"And I'll get the frying pan to fry the Mouse," said the third.

"And I'll have the biggest helping when they are all cooked," said the fourth, who was the greediest of all.

So the four little Foxes jumped for joy, and the big bad Fox went to get his sack ready to start upon his journey.

But what was happening to the Cock and the Mouse and the Little Red Hen all this time?

Well, sad to say, the Cock and the Mouse had both got out of bed on the wrong side that morning. The Cock said the day was too hot, and the Mouse grumbled because it was too cold.

They came grumbling down to the kitchen, where the good Little Red Hen, looking as bright as a sunbeam, was bustling about.

"Who'll get some sticks to light the fire with?" she asked.

"I shan't," said the Cock.

"I shan't," said the Mouse.

"Then I'll do it myself," said the Little Red Hen.

So off she ran to get the sticks.

"And now, who'll fill the kettle from the spring?" she asked.

"I shan't," said the Cock.

"I shan't," said the Mouse.

"Then I'll do it myself," said the Little Red Hen.

And off she ran to fill the kettle.

"And who'll get the breakfast ready?" she asked, as she put the kettle on to boil.

"I shan't," said the Cock.

"I shan't," said the Mouse.

"I'll do it myself," said the Little Red Hen.

All breakfast-time the Cock and the Mouse quarrelled and grumbled. The Cock upset the milk jug, and the Mouse scattered crumbs upon the floor.

"Who'll clear away the breakfast?" asked the poor Little Red Hen, hoping they would soon leave off being cross.

"I shan't," said the Cock.

"I shan't," said the Mouse.

"Then I'll do it myself," said the Little Red Hen.

So she cleared everything away, swept up

The Little Red Hen swept up the crumbs and brushed up the fireplace, but the Cock and the Mouse were very lazy.

the crumbs and brushed up the fireplace.

"And now, who'll help me to make the beds?"

"I shan't," said the Cock.

"I shan't," said the Mouse.

"Then I'll do it myself," said the Little Red Hen.

And she tripped away upstairs.

But the lazy Cock and Mouse each sat down in a comfortable armchair by the fire, and soon fell fast asleep.

Now the bad Fox had crept up the hill, and into the garden, and if the Cock and Mouse hadn't been asleep, they would have seen his sharp eyes peeping in at the window. "Rat tat tat, Rat tat tat," the Fox knocked at the door.

"Who can that be?" said the Mouse, half opening his eyes.

"Go and look for yourself, if you want to know," said the rude Cock.

"It's the postman perhaps," thought the Mouse to himself, "and he may have a letter for me." So without waiting to see who it was, he lifted the latch and opened the door.

As soon as he opened it, in jumped the big Fox, with a cruel smile upon his face!

"Oh! oh! oh!" squeaked the Mouse, as he tried to run up the chimney.

"Doodle doodle do!" screamed the Cock, as he jumped on the back of the biggest armchair.

But the Fox only laughed, and without more ado he took the little Mouse by the tail, and popped him into the sack, and seized the Cock by the neck and popped him in, too.

Then the poor Little Red Hen came running downstairs to see what all the noise was about, and the Fox caught her and put her into the sack with the others. Then he took a long piece of string out of his pocket, wound it round and round and round the mouth of the sack, and tied it very tight indeed. After that he threw the sack over his back, and off he set down the hill.

"Oh! I wish I hadn't been so cross," said the Cock, as they went bumping about.

"Oh! I wish I hadn't been so lazy," said the Mouse, wiping his eyes with the tip of his tail.

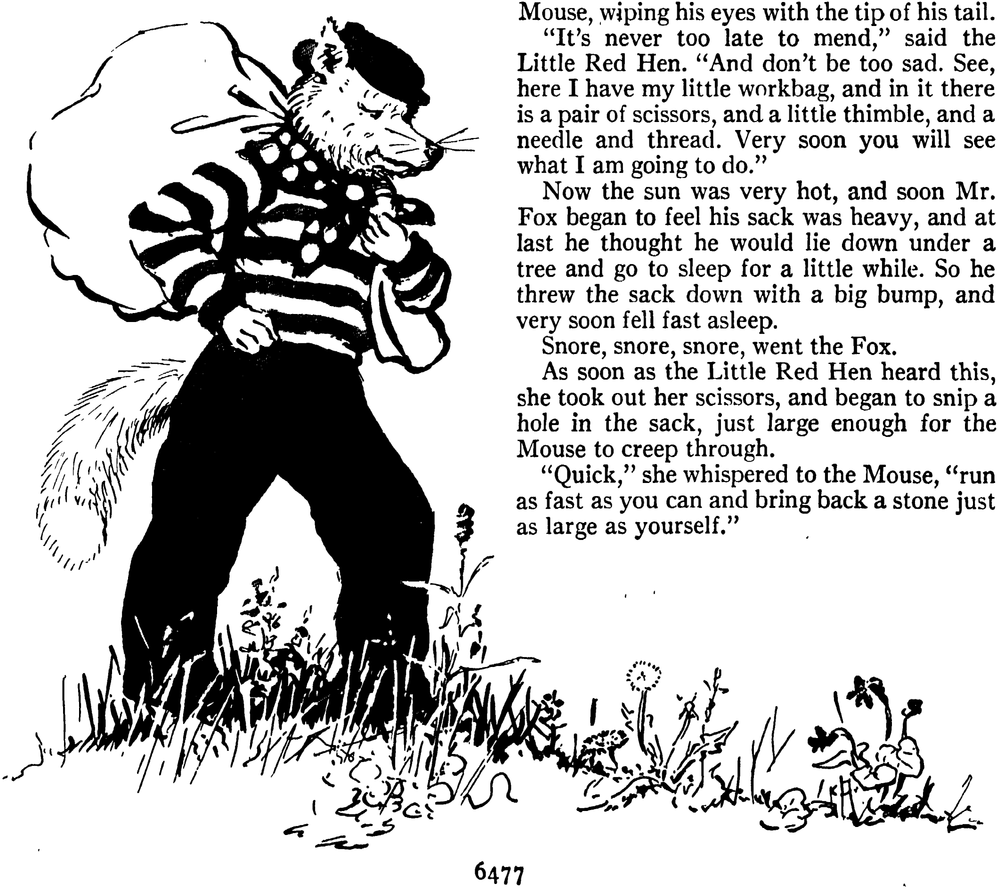
"It's never too late to mend," said the Little Red Hen. "And don't be too sad. See, here I have my little workbag, and in it there is a pair of scissors, and a little thimble, and a needle and thread. Very soon you will see what I am going to do."

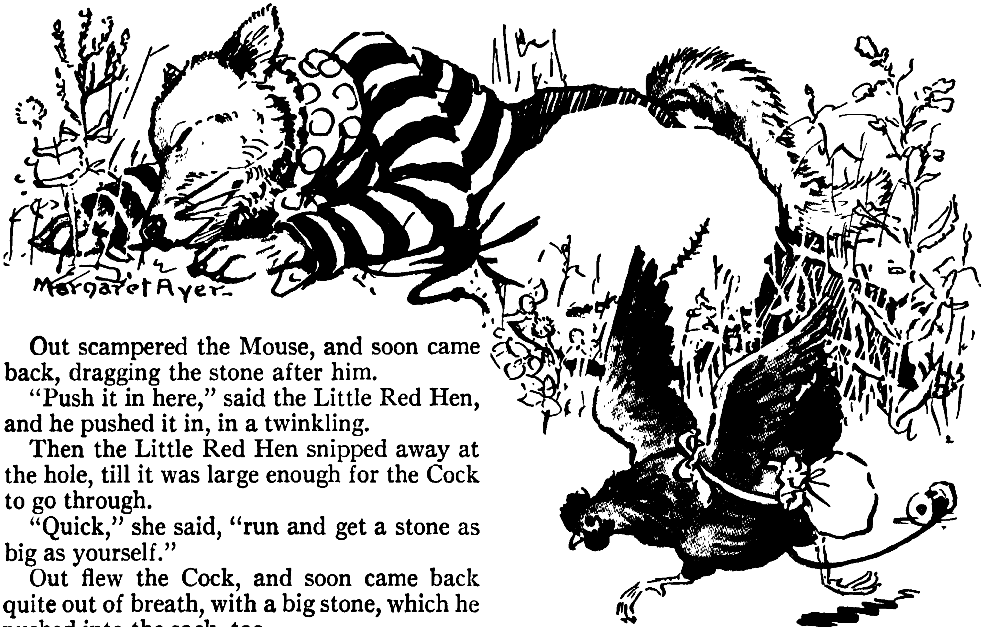
Now the sun was very hot, and soon Mr. Fox began to feel his sack was heavy, and at last he thought he would lie down under a tree and go to sleep for a little while. So he threw the sack down with a big bump, and very soon fell fast asleep.

Snore, snore, snore, went the Fox.

As soon as the Little Red Hen heard this, she took out her scissors, and began to snip a hole in the sack, just large enough for the Mouse to creep through.

"Quick," she whispered to the Mouse, "run as fast as you can and bring back a stone just as large as yourself."





Out scampered the Mouse, and soon came back, dragging the stone after him.

"Push it in here," said the Little Red Hen, and he pushed it in, in a twinkling.

Then the Little Red Hen snipped away at the hole, till it was large enough for the Cock to go through.

"Quick," she said, "run and get a stone as big as yourself."

Out flew the Cock, and soon came back quite out of breath, with a big stone, which he pushed into the sack, too.

Then the Little Red Hen popped out, got a stone as big as herself, and pushed it in. Next she put on her thimble, took out her needle and thread, and sewed up the hole as quickly as ever she could.

When it was done, the Cock and the Mouse and the Little Red Hen ran home very fast, shut the door after them, drew the bolts, shut the shutters, and drew down the blinds and felt quite safe.

The bad Fox lay fast asleep under the tree for some time, but at last he woke up.

"Dear, dear," he said, rubbing his eyes and then looking at the long shadows on the grass, "how late it is getting. I must hurry home."

So the bad Fox went grumbling and groaning down the hill, till he came to the stream. Splash! In went one foot. Splash! In went the other, but the stones in the sack were so heavy that at the very next step down tumbled Mr. Fox into a deep pool. And then the fishes carried him off to their fairy caves and kept him a prisoner there, so he was never seen again. And the four greedy little Foxes had to go to bed without any supper.

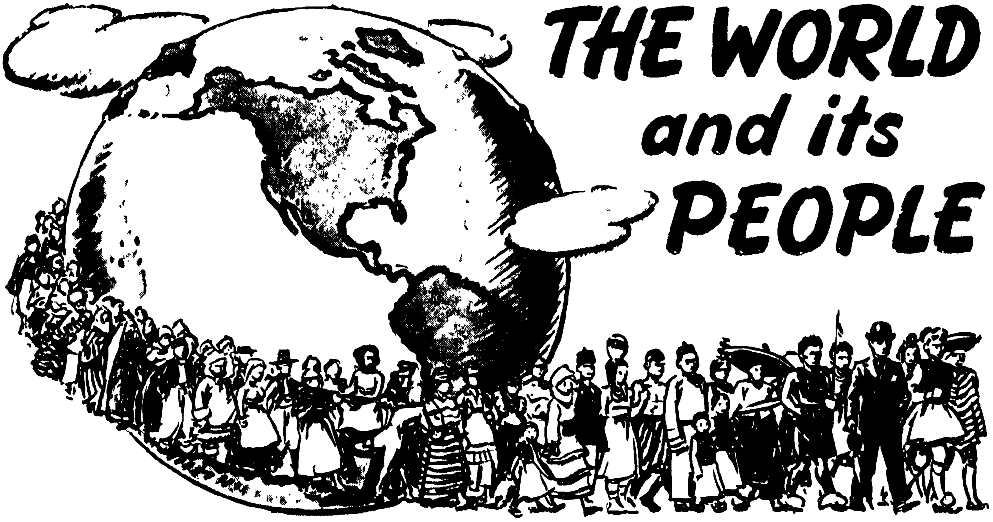
But the Cock and the Mouse never grumbled again. They lit the fire, filled the kettle, laid the breakfast and did all the work, while the good Little Red Hen had a holiday and sat resting in the big armchair.

No Foxes ever troubled them again, and for all I know they are still living happily in the little house with the green door and green shutters, which stands on the hill.

THE NEXT READ ALOUD STORIES ARE ON PAGE 6997.

The Cock and the Mouse and the Little Red Hen ran home very fast, and shut the door after them and drew down the blinds.

THE WORLD and its PEOPLE



THE SPREAD AND GROWTH OF POPULATIONS

No one can tell how long human beings have lived upon the earth; nor can one stick a pin in a map and say with certainty "Here was the cradle of mankind." Mesopotamia, the North Pole and the Lost Atlantis (a continent now supposed to be sunk beneath the ocean) all have their champions; the high central plateau of Asia is the choice of many modern scientists as the starting-point of man.

However, this we know—that if you go back far enough, all types of men now on earth had a common origin. All men belong to one great family; though long, long ago there was separation into groups, and the groups moved outward from their center or centers, and a gradual development of different types (which we call races) took place.

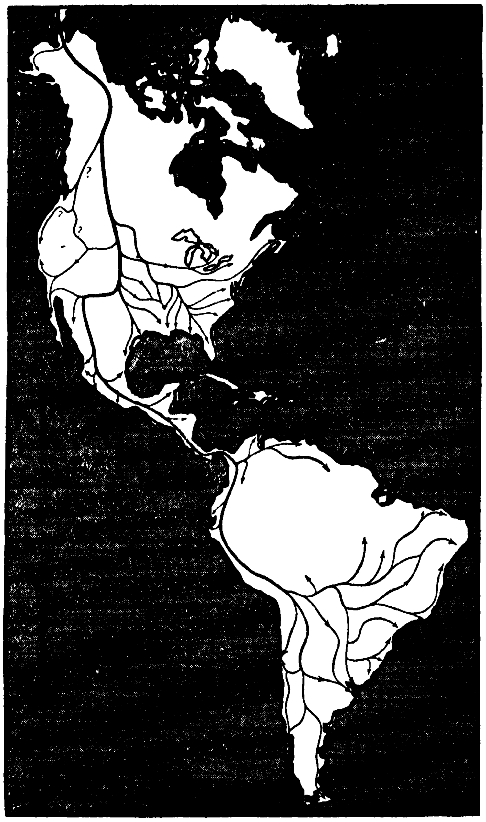
We have a special name for the first human settlers in the great habitation areas of the globe. We call them aborigines. (In North America, for instance, the aborigines were the red men.) The aborigines of each area learned to adapt themselves to the conditions of the area—their bodies learned to endure extreme cold, or heat, or high or low altitudes or other conditions. Through this adaptation, and through handing chance features along from generation to generation, each group developed its own special traits, which we now call race characters.

Thus, in the region of central Africa, south of the Sahara Desert, there developed what we know as the Negro type, characterized by a very dark skin, kinky hair, a rather flat, broad nose, thick lips and various other features.

North Africa and Europe, in history and in race development, constitute a single region in spite of the Mediterranean Sea; there grew the race known as Caucasian or "white." Although we rightly regard it as a single race, this group shows a high diversity of features. The skin color ranges all the way from a very pale pink to very dark, the hair from flaxen through brown to black, the eyes from blue through grey and brown to black, and the head form from long through medium to round.

In central Asia the population, although maintaining its existence upon the original site, departed probably as far from the basic type as any of the other races, resulting in the yellowish skin, straight black hair, high cheek bones and black "slanting" eyes which we associate with the Mongolian race.

The American continents were probably peopled much later than the Eastern Hemisphere, and primarily by offshoots of the basic Mongolian stock. Consequently, the so-called red men are sometimes considered as a separate race, and sometimes as a subdivision of the Mongolian race. In Australia and Oceania we find the Malay peoples, which are sometimes considered as one of the five basic



American Geographical Society of N. Y.

Wanderings of early peoples through the Americas

races, and sometimes as a subdivision of the Mongolian.

Let us go back now to the time when there existed a group or a small number of groups, consisting of a few hundreds or thousands of individuals, destined to be the forefathers of all the men who have lived since. These early humans devoted a large part of their time and energy to the two great life processes of eating and reproducing. They were very closely dependent upon the supplies that nature furnished ready to hand. They had as yet developed no implements or techniques for increasing their supplies. They roamed over the face of the earth collecting nuts, berries and small fruits, grass seeds, grubs and insects, and such small animals and fish as they could catch with their unaided hands.

As you can imagine, this represented a very limited source of food supply, and also one that was relatively fixed and did not increase year by year. At the same time, the race of man was increasing slowly but steadily. Physiologically mankind was capable of doubling its numbers every fifteen years or so, but it was quite impossible to provide food for such a rapid increase.

HOW MANKIND DEALT WITH THE PROBLEM OF PROVIDING FOOD FOR ITSELF

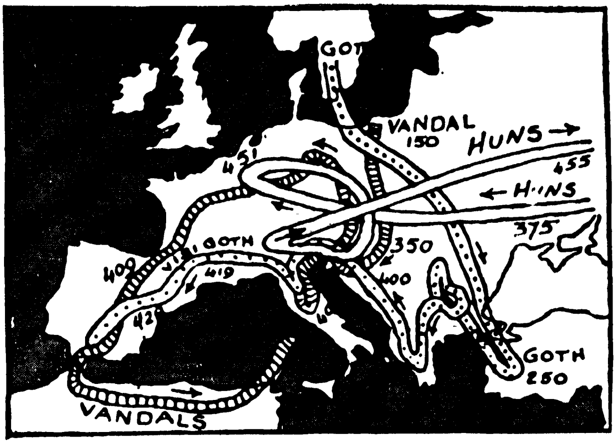
There thus arose, even at this very early time, the greatest single problem with which mankind has ever had to deal—the problem of providing food enough to keep pace with the increase in numbers. The simplest of all solutions to this problem was continually to utilize fresh land. This could be done by moving into new regions, and, as we nave already seen, this is what mankind actually did. The original peopling of the earth's surface was, therefore, a natural reaction to what we call "population pressure"—that is, the tendency of human groups to lack sufficient food to care for their steadily increasing numbers. This process, of course, could not continue forever. If men had remained absolutely dependent upon the food supplies offered by wild nature, the time would have come when all the available land of the world would be occupied.

Fortunately, long before this fatal point was reached, men were beginning to achieve some control over their environment. Little by little they learned how to improve and increase the natural food supplies. They domesticated sheep, cattle and other animals. They learned how to increase the number and the size of these creatures, which were good to eat, and they also learned to rely largely upon milk for food. By developing the arts of agriculture, they vastly increased the food yield of wild grasses and fruits. More and more of the land's surface was now given to food-producing plants instead of to useless vegetation.

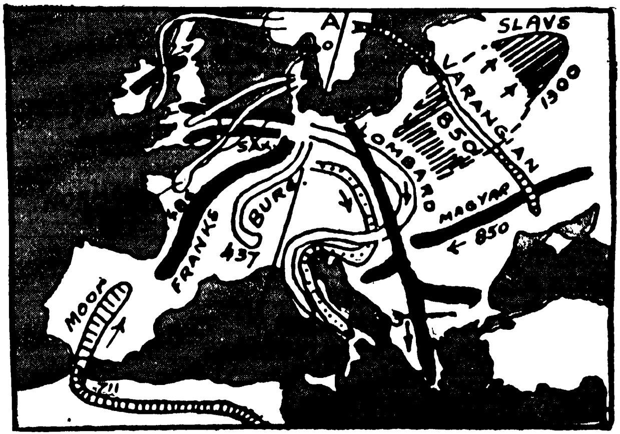
THE DEVELOPMENT OF TOOLS AND MACHINES OPENS UP VAST NEW NATURAL RESOURCES

At the same time, there were also developing what we call the "industrial arts." Tools and implements of all sorts were invented, and eventually machines of innumerable kinds. The effect of invention was to open up vast new natural resources which could be made to provide food, and also clothing, housing and a thousand and one other human needs.

Thus the spread of mankind over the earth's surface and the growth of human civilization, or culture, went on together. Numbers increased, and the "standard" or "level of living" improved at the same time, and in a closely related way. But the process, at best, was very slow. We have no accurate figures as to the numbers of mankind, even in the more rapidly progressing regions, down to the very recent times. We are even uncertain as to the exact populations of ancient Egypt, Greece and Rome. But we may be sure that for ages the total population of the earth increased very slowly, and the mode of life improved so gradually that there was very little consciousness of betterment from generation to generation. Thus there became firmly established the notion that about all men could hope for was to live as well as their ancestors had lived.



This map shows the principal migrations of the Goths, Visigoths (that is, West Goths), Vandals and Huns from 100 to 450 A. D.



From ENVIRONMENT, RACE, AND NATION, by T. G. Taylor, Univ. of Tor. Pr.

The lower map, by the same artist, shows the later migrations of peoples in the European continent in the period from 437 to 1300.

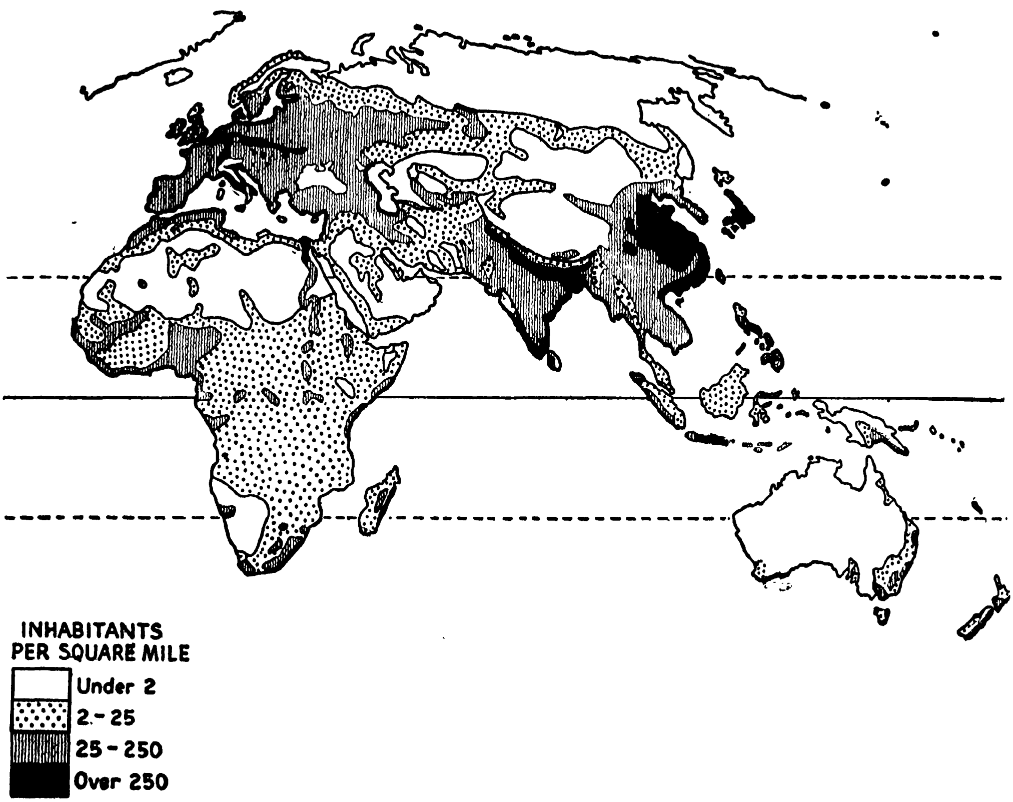
So things went on until the beginning of the "modern era," which dates from about the middle of the eighteenth century. By this time the American continents had been discovered by peoples of a relatively high civilization. They took advantage of the natural resources of America as the aborigines (the red men) had never been able to do. Nevertheless, even in the hands of the English, French, Dutch, Portuguese and Spanish the progress of these lands had been very slow for a couple of centuries or so.

Then, very suddenly, during the closing years of the eighteenth and the early part of the nineteenth centuries, an extraordinary expansion took place. This was due to a remarkable set of technical inventions and discoveries, many of them coming from England. These included various types of textile machinery, the use of steam power and of coal for fuel and the coming of the factory system and mass production.

The rich, new Western World, with its vast resources, and the inventions and improvements we have just noted, had an era of prosperity unheard-of (over such a wide area) in all history. Eventually much of the world began to take part in this period of wealth and expansion. First came the inventions of machines and the harnessing of power to run them; then factories grew; then men discovered that if a job could be broken down into different parts, or operations, and each worker did one operation, he would develop great skill and speed and much more work would be done. This is called the division of labor. Mass production is based on it.

This era showed an extraordinarily rapid growth in the population of the world. In the year 1800 there were something like 900,000,000 people in the world. Today there are about 2,200,000,000. The population of the earth has much more than doubled in less than a century and a half. Or, putting it otherwise, it took a million, or two million, years for mankind to roll up a grand total of 900,000,000 individuals, and then in the next 140 years there were added over 1,000,000,000 more.

And the remarkable thing is that at the same time the output of material goods was so greatly increased that men found themselves living more comfortably and securely than had ever been the case previously. This



From ENOUGH AND TO SPARE, by K. F. Mather, publ. by Harper & Bros., N. Y. and London.

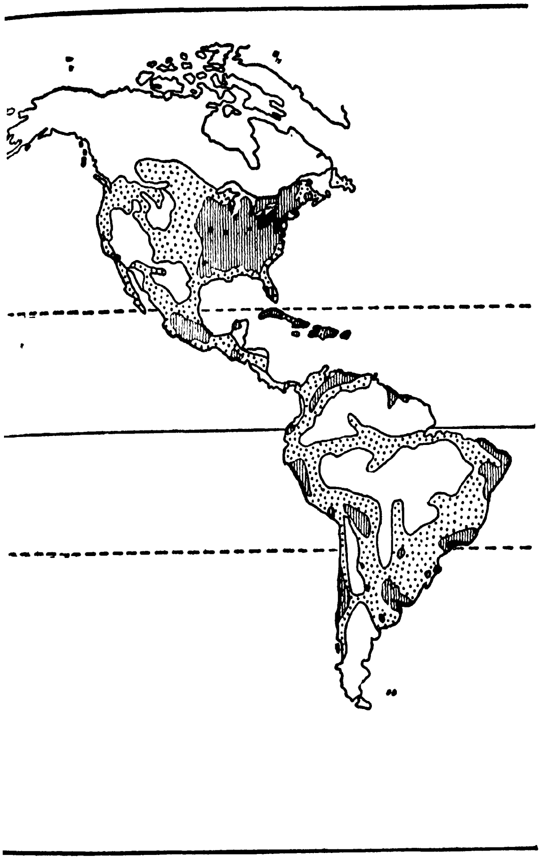
The world's territories are very unevenly peopled, as this map shows. Many of the regions with less than two

was especially true in those Western lands which enjoyed most benefits from the new forces. Thus the population of the United States increased from about 4,000,000 in 1790 to 132,000,000 in 1940, or an increase of 33-fold in a century and a half. At the same time, the people of the United States built up a higher material level of living than had ever been known by a population of comparable size in human history.

As a result of these great advances, men took it cheerfully for granted that the future would be just a brighter copy of the present. But it should have been clear to any careful thinker that this sort of thing could not continue forever. The simplest mathematics would show that it is impossible to go on indefinitely multiplying the population of the world two-fold in every century and a half without meeting terrible problems due to population pressures in various parts of the globe.

World War I and World War II may both very reasonably be considered as the reaction to this situation. The tremendous momentum of population growth came up against limitations of material production; and the countries of the world were thrown into conflict with each other. We kept hearing various stock phrases such as "free access to raw materials," "have and have-not nations" and so on. (In fact, most nations are "haves" in respect to some goods, and "have-nots" in respect to other goods.) All of this simply meant that when certain peoples of the world found it no longer possible to provide for their own members in the way they wished, they turned to force and encroached upon the territory of others.

The immediate and direct causes of war between nations are many and complex. Political ambition, cultural arrogance, trade rivalry and national aggressiveness are some causes; but underlying them all is this hard, basic fact of population pressures.



inhabitants to a square mile are deserts or frozen wastes.

As we have seen, in the long extended past men have been able to avoid a state of perpetual crisis by two great expedients—moving into unoccupied territory and improving the technical arts of life. With the peopling of the Western Hemisphere, the former of these expedients is approaching an end. Science and the development of the technical and industrial arts will undoubtedly go on indefinitely, and therein lies the greatest single hope for human material welfare and the avoidance of international conflicts.

As already stated, the population of the world is around 2,200,000,000. This grand total is distributed among the different continents about as follows:

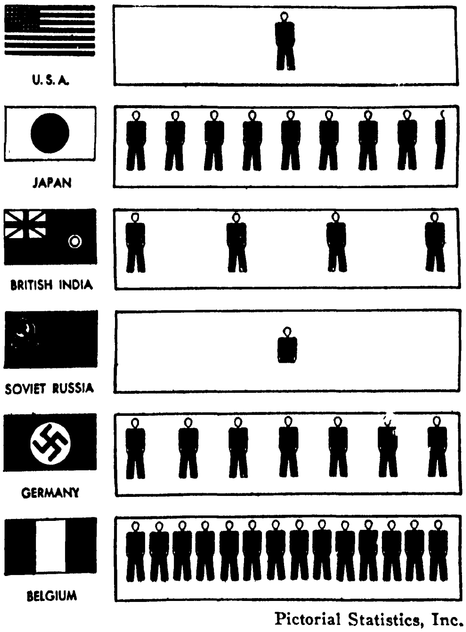
Europe	522,000,000
Asia	1,208,000,000
Africa	158,000,000
North America	190,000,000
South America	85,000,000
Australia and Oceania	11,000,000

The great continent of Asia thus contains more than half of all humanity, and it is partly for this reason that some of the most acute problems of the day radiate from Asia. Among the respective countries or nations, the total population is very unevenly distributed. Some lands are very densely crowded, others are sparsely populated. As a measure of this factor we use what is known as the "density of population." In its crude form, this expresses simply the number of individuals per unit of area (in English-speaking countries, ordinarily one square mile). Some typical cases are set forth in the following table:

COUNTRY	PERSONS PER SQUARE MILE
Great Britain	516.3
United States	44.2
U.S.S.R.	20.8
China	145.6
Japan	469.0
India	270.2
Brazil	14.0
Argentina	12.2
Canada	3.3

Of course, these figures taken by themselves do not tell anything about the material prosperity or wealth of the individual countries. Countries like England and Belgium are highly industrialized and depend upon

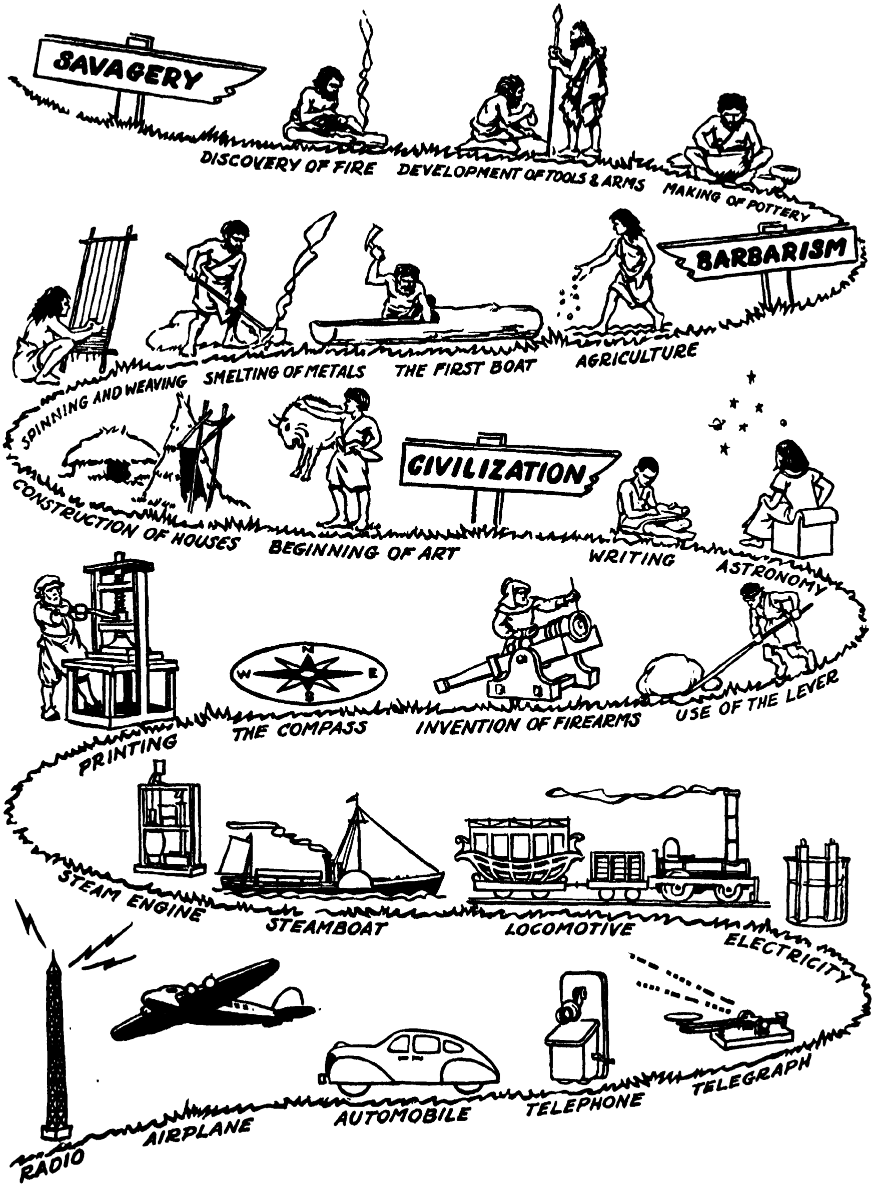
DENSITY OF POPULATION



Pictorial Statistics, Inc.

The density of population in six countries in 1939.

MILESTONES in the MARCH of CIVILIZATION



other lands for a large portion of their food supply. And yet these figures do give a real indication as to the difference between the problems faced by China and Japan and those of Canada, Brazil and Argentina.

This relation between population and territory (which is called the "man-land ratio") is so important that specialists in the field, and ordinary thoughtful people, recognize two opposite conditions—"underpopulation" and "overpopulation." As the words themselves indicate, underpopulation refers to a situation where there are not enough people in a country to provide for its highest possible development. Overpopulation means that there are too many people to allow the greatest well-being.

A COUNTRY'S PROSPERITY IS MEASURED BY ITS PEOPLE'S STANDARD OF LIVING

The prosperity, or well-being, of a country is frequently measured by the simple material well-being of the people. We call it the standard, or level, of living. If the country is underpopulated, there are too few people to make it possible for each individual or family to have as good a house and as much food, clothing and simple comforts and luxuries as he might enjoy if the population were larger. If the country is overpopulated, it means that there are so many people trying to get a living from a given amount of land that on the average none of them can live so well as if they were not so crowded. Over the long stretch of human existence, of course, overpopulation has caused more trouble than underpopulation. As a matter of fact, underpopulation is a relatively rare situation. It corrects itself, usually; that is, the population increases very rapidly and soon catches up.

It is quite clear, logically, that between these two extremes there must be a middle ground where conditions are favorable, and the people live as well as is possible, taking into consideration their land resources and their economic development. This happy state is ordinarily referred to as "optimum population."

THE UNITED STATES IS ABLE TO PROVIDE FOR THE NEEDS OF ALL ITS PEOPLE

Out of World War II certain countries are emerging as grievously overpopulated. Others, particularly those that have suffered the heaviest losses in man-power, may regard themselves as underpopulated. Probably the United States is as near to the happy medium as any great nation. The country has about 135,000,000 people distributed unevenly over 3,735,223 total square miles, or 3,022,387 square miles in the continental area. This gives an average density of population of 40.3 for the entire possessions, or 43.6 for the continental portion. This is certainly not extreme congestion, and if the United States makes use of its resources, its technology and its man-power intelligently and scientifically it should be able to provide amply fo the material needs of all its people.

CANADA, WHICH IS UNDERPOPULATED, FACES A PERIOD OF RAPID EXPANSION

Canada, on the other hand, is underpopulated; yet it has, during the war years, greatly developed industrially. It seems probable that Canada faces a period of rapid expansion and rising prosperity. Its natural resources are immense and have scarcely been tapped.

The population of a country increases or decreases as a result of the operation of three basic factors: births, deaths and migration. For the world as a whole, of course, only the two former apply, as there is as yet, in spite of all talk about rocket planes, no migration out of or into this planet. Leaving migration aside, in a particular country if the number of births in a year is greater than the number of deaths the population grows. If the deaths exceed the births, the population diminishes. If births and deaths are exactly equal, the population remains stationary.

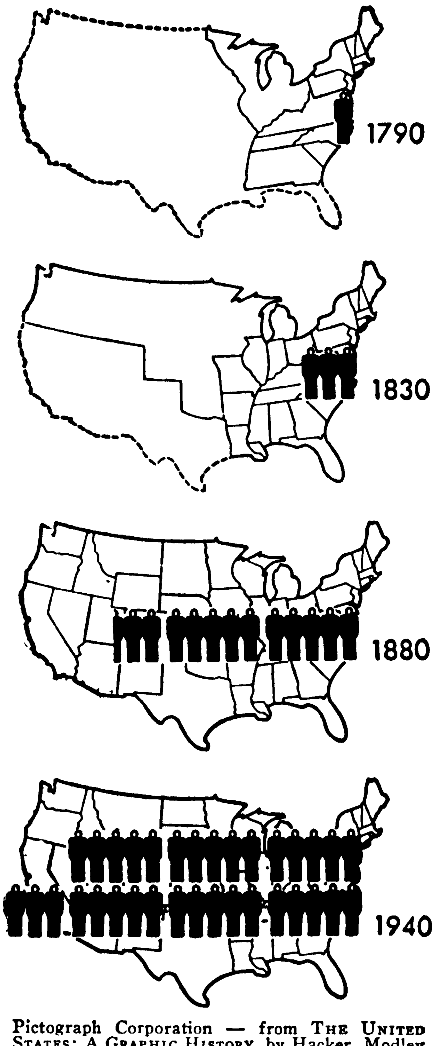
HOW WE DETERMINE THE BIRTH RATE AND THE DEATH RATE OF A COUNTRY

For purposes of comparison, the aggregates of births and deaths are reduced to the form of "rates," which are ordinarily expressed in the number of births or deaths per thousand of population. The difference between the birth rate and the death rate in a given year represents the rate of natural increase for the year. This is a minus quantity if the population has been falling off.

During the period of great expansion since the beginning of the nineteenth century, the trend of the birth and death rates in most civilized countries has shown a fairly uniform pattern. In general, death rates have gone down as a result of various scientific and technical advances, particularly those in the fields of medicine, hygiene and public health. In the United States, for example, the death rate has declined from something like 29 in 1800 to 10.8 in 1943. (We find much higher death rates in the so-called backward countries of the world.) During the same period, the birth rate has also been generally on the decrease. Indeed, in many countries, the decline in these two rates has been nearly enough alike to leave the rate of population growth practically unchanged. Thus in the United States, the population continued to grow at a fairly stable ratio until about the year 1870, when there set in a decline in the rate of growth. This became extreme in about the year 1930. The birth rate reached an all-time low of 16.6 in 1933. For the next few years it remained about constant, and then showed a marked increase during the early years of the war. It is entirely probable that it will remain somewhat above the death rate for a number of years to come so that the country may look forward to a slowly growing population.

In some other countries the rate of population growth has remained tremendous. For example, the actual *increase* of population in the continent of Asia between the years 1800 and 1933, according to the best estimates, was 519,000,000, which happens to be precisely the same as the *total* population of Europe in 1933. The population of India increased by over 50,000 between 1931 and 1941. Japan has announced its deliberate intention to have a population of 100,000,000 in the year 1960, and to be the most rapidly growing country in the world.

The human losses of World War II are enormous in China and Japan, but past experience has shown us that man can make up these huge deficiencies in a few years if peace and prosperity prevail. Some of the very greatest problems of the peace will revolve around the question of providing for these large and rapidly growing nations. Urgent proposals will be made to relieve some of these overcrowded countries by allowing extensive migration into the territory of the less crowded peoples. However, such remedies must be viewed with great caution, as they offer only temporary help.



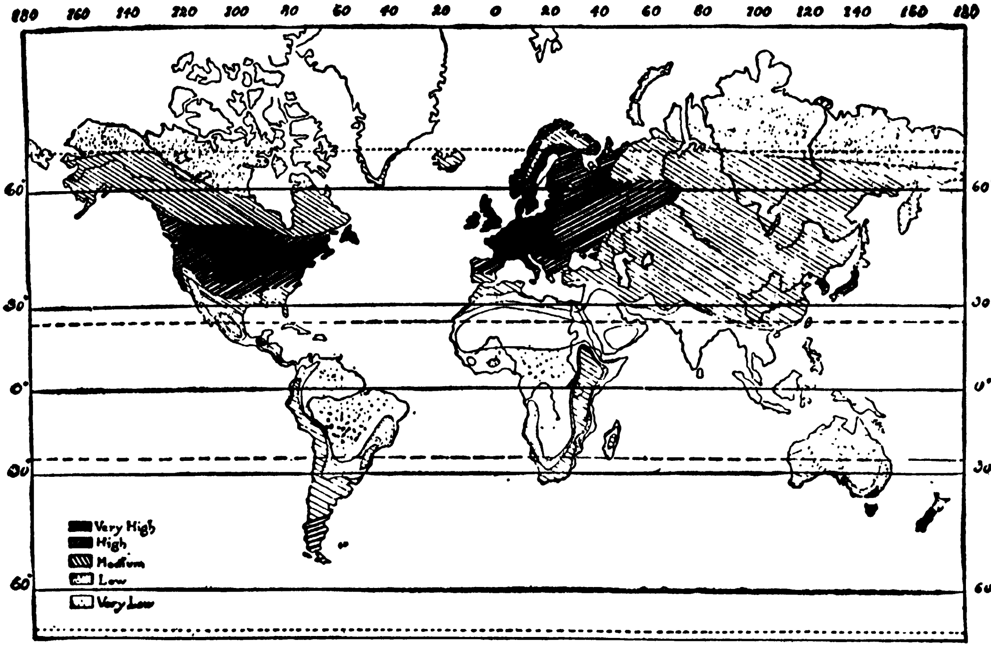
Pictograph Corporation — from The United States: A Graphic History, by Hacker, Modley and Taylor. Publ. by Modern Age Books, Inc.

The four maps shown above show the growth and spread of population in the United States.

So far, we have discussed quantities of population. Quality is fully as important, and therein may lie the answer to our present problem. The qualities of a human group depend, first, upon the inherited qualities which are passed on from generation to generation, and second, upon the traits and abilities which are built into a group through education, experience, training and so on. Every civilized country lays great stress upon the latter set of influences, and much of human progress is traceable to it.

Man has, by the education of his wits, learned to increase enormously many of the earth's yields. He can keep soil fertile and grow the crops to which each field is best suited. He can even grow crops without soil, by giving the roots the chemical food-factors they need. He can ship food long distances without spoilage, and we have the promise of engineers that this ability will soon be expanded — so that many tropical foods will appear on our tables which could never be shipped before. This could vastly aid the food problem of temperate-zone people, since vegetation grows so extravagantly in the tropics.

Men have also pushed the "growing-line" farther north, developing quick-maturing grains to take advantage of short summers. This has had the effect of pushing the "population line" farther north also.



From Civilization and Climate, by E. Huntington, Yale Univ. Press

This chart shows the effect of climate on human energy, taking factory work all over the world as a measure. You will see that energy seems to be highest in the temperate zones, tapering off toward both hot and cold regions.

Animals have been bred for special purposes—hens that give more eggs or meat, cattle that give more milk or meat, sheep that give more wool or more meat. The study of nutrition has shown us how to have a better diet on less food; and it is a fact that we eat less than our grandparents ate. In these and many other ways we have learned and will learn to improve our use of the good earth. We make fertilizer out of the air, and textiles out of air, water and limestone (or coal or some other common material). It is not too fantastic to think that we may one day get even some of our own sustenance from the air itself.

We have already learned to keep the supply of fresh-water fish from running out, and we grow oysters on undersea "farms." The sea can be made to yield more of our plant and animal food. As the earth's populations spread over every nook and corner on the globe, man must count more and more upon his ingenuity. He must use more intensively the resources of earth, air and water, and see that the resources are constantly renewed. He may have to educate his mind and adapt his body to conditions that seem to us now to be fantastic. Let us remember at this point that man thinks of the whole earth as his home, yet he lives only on the land, less than one-quarter of the whole area—and he dwells in numbers only on a small part of that quarter, disdaining (with a few exceptions) the tropics and frigid areas, and numberless islands.

We may go back to Mother Goose for an illustration. There was, it seems, an old woman who lived in a shoe that was very much overpopulated. The old woman gave her children some broth without any bread and whipped them all soundly and put them to bed, presumably so they could forget their hunger in sleep.

Now there was at this time another old woman, a widow, who lived in the city of Babylon. She also had a large family, and they were all girls, which was worse. But she was a great believer in practical education. She taught her girls—made each one an expert—one could bake and one could brew, and one could shape and one could sew, one could sit by the fire and spin and one could make a cake for a king. We do not see these girls going supperless to bed.

The problem of the world's populations can not be solved by a nursery rime; but perhaps there is at least a nugget of primitive wisdom here.

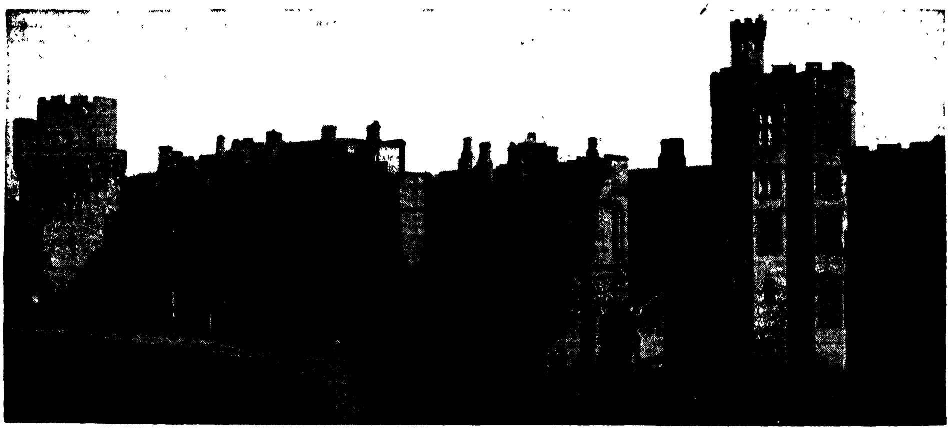
By Henry Pratt Fairchild

THE NEXT STORY OF ALL COUNTRIES IS ON PAGE 6583.

THE STATELY HOMES OF ENGLAND

WINDSOR CASTLE, THE HISTORIC HOME OF THE KINGS OF ENGLAND

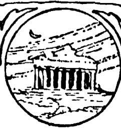
BURGHLEY HOUSE, NEAR STAMFORD, BUILT IN THE SIXTEENTH CENTURY



WARWICK CASTLE, BUILT IN THE FOURTEENTH CENTURY

St. John's College, Cambridge.

FOUR CENTURIES IN EUROPE



THE Gothic period in England produced a very finished architecture that was much more suited to cathedrals and churches than any other kind of building. We might almost say that the Englishman's church came to life fully grown, but it took some centuries for the "stately homes of England" to reach perfection.

A number of the famous examples of architecture mentioned in this article were either completely ruined or damaged almost beyond repair during World War II. It may be some years before the extent of the destruction can be fully reckoned, but here we describe these buildings as they once were.

In the thirteenth century the castle became a little more human. The great hall of the Norman keep had served as dining-room, bedroom and sometimes kitchen. Now we find rooms were built for guests in a sheltered part of the castle. Another hundred years or so and a banqueting hall, kitchens and other rooms were added. Warwick Castle and Warkworth, Northumberland, are most interesting specimens of these early domestic fortresses. In Scotland the best known is Glamis, in Forfarshire.

The castle gave place, as social conditions changed, to the manor house. This was like a little village. The house itself grouped around a large hall which had a fireplace and was generally backed by the kitchen, which also had a fireplace. In all the house no other fires were possible. From this central hall ran out, right and left, the rest of the house, rooms opening into each other, upstairs generally branching out from an open gallery that looked down into the hall.

The house was of stone or sometimes brick. The windows were very small, and in the earliest period were merely shuttered; later came those leaded casements which we are so fond of putting into new country cottages built on old lines. Around the manor house were built the various smaller places which in those days supported life: the dairy, bakehouse, brewhouse, smith's house, and so forth. Nearly always, too, there was a private chapel somewhere on the manor's precincts.

As the need for fortification ceased, the manor house spread itself out more, added courtyards and wings, summer and winter parlors, and a great many private rooms. Houses of this order are Penshurst Place in Kent and Haddon Hall in Derbyshire.

The reign of Henry VIII saw the

last great building set up in England before the echoes of the Italian Renaissance upset the architects of Elizabeth's reign. This is Hampton Court Palace, built by Cardinal Wolsey for himself and liked so much by Great Harry that the cardinal thought it tactful to make his master a present of it. The king made certain additions, and later Sir Christopher Wren found it necessary to pull down the east part and rebuild it in Renaissance style.

The interest of the palace is the original Tudor building, erected in the style that had developed by way of the English manor house, and lightly flavored by the work of the Italian craftsmen Wolsey drew in. The famous Clock Court, built in a diaper-patterned brickwork, with battlemented parapets and delightful Tudor chimneys, is an eternal treasure. In the court we see the square-headed windows, the low graceful mullions, the fine oriel of the gatehouse, and recognize what early Tudor domestic architecture, born of English Gothic, means.

The great hall of the palace is one of the finest in Europe. Its hammer-beam roof, with that of Westminster Hall, built centuries earlier, and that of the Middle Temple Hall, London, built a little later, are souvenirs of great bygone genius in workmanship.

WHAT WE MEAN BY THE "TUDOR CHAOS"

The houses built in Elizabeth's reign were of a different character—in a way had fallen from grace—were of a confused style, over-ornamented, decorated with Italian details regardless of suitability by German and Flemish workmen who were in England in great numbers at the time. In architectural history these years between the Gothic and the Renaissance are termed the "Tudor chaos." The half-timber constructions, the gables, the quaintness will always be interesting, even if the façades show too many curls and twists.

The interiors of the Elizabethan houses were very richly carved and planned. The great hall was still so much the core of the building as to draw to itself all that was most lovely in the work of the time—in paneling, fireplaces, windows, open-beamed carved roofs. Great staircases and the "long gallery" became notable features of the Elizabethan mansion. Outwardly, in plan the E-shaped formation appeared, as if a quadrangle had been cut in half to let in sunlight and air.

Little Moreton Hall in Cheshire, Longleat House in Wiltshire, and Sizergh Castle in Westmoreland are three characteristic houses in a reign that produced a great many. As the Elizabethan period slid into the Jacobean and the Renaissance influence became more strongly felt, another great company was added: mansions like Audley End in Essex, Hatfield House in Herts, and Holland House in Kensington.

Magnificent buildings of a public nature rose in England during the Gothic years and early Renaissance: most of the colleges and chapels of Oxford and Cambridge, the main part of the Inns of Court, London, the guildhalls, schools, hospitals and almshouses (for these were the centuries when for pious motives people endowed hospitals and almshouses for the needy and the infirm). The oldest almshouse in England is the Hospital of St. Cross, built in 1136 and endowed by Bishop Henry of Blois for "thirteen poor and aged men." The fine old Bede House, Stamford, was built in 1490 for "ten poor men and two nurses."

THE RENAISSANCE AND INIGO JONES

We have now reached a dividing line. The first person who greets us on the other side is Inigo Jones—not that he was the first Renaissance architect, but that he stood above the company. Once the sixteenth century has passed, English architecture is looked at from the point of view of two giants, Inigo Jones and Christopher Wren.

Inigo Jones, the son of a cloth-worker, was born in 1573 in the parish of St. Bartholomew's, Smithfield. When he was still a young man he made two journeys to Italy and rambled all over the country with Palladio's book on architecture. He came back steeped in Italian architecture; in 1615 he was given the post of Surveyor-General of His Majesty's Works and began his labors as an architect.

His first great work, started in 1619 and carried over many years, was the rebuilding of Whitehall Palace. Owing to Charles I's being so short of money only the banqueting hall was finished—now the United Service Museum in Whitehall. This is the first true Renaissance building to be set up in England; we see for the first time the pilasters, pediments and balustrades of the Italian art.

Inigo Jones showed himself at once capable of managing large masses of architecture from the point of view of proportion and distribution of weight. After this he was kept very busily employed. His next important work was the planning of the group now known as the Greenwich Hospital. He built Queen Henrietta's House for the wife of Charles I, and thus set going a magnificent group which Wren finished and which Queen Mary turned into a hospital for disabled seamen. He was fined and imprisoned in the Civil War, but as soon as the turmoil was over, continued his building again. He died in the midsummer of 1652 and was buried by the side of the old cloth-worker, his father, in St. Benet's Church, which Wren rebuilt thirty years later.

CHRISTOPHER WREN AND HIS GREAT ACHIEVEMENT

Christopher Wren, the second great architect of the century, was born in 1632 and busied himself till he was nearly thirty on scientific problems, astronomy and various inventions. In 1661 he was appointed Assistant Surveyor-General of His Majesty's Works, the post Inigo Jones had held. His first works were Pembroke College Chapel, Cambridge, and the Sheldonian Theatre, Oxford. The master's best work in Oxford is the interior of Trinity College Chapel.

A brief six months in Paris, where he met Bernini, the Italian, and the other best artists of the age assembled for the building of the Louvre, then he came back to London, where the Great Fire gave him the most wonderful opportunity that any architect ever had. He built fifty-three churches within the sound of St. Paul's bells, of which his finest is generally supposed to be St. Stephen's, Walbrook, and his loveliest steeple that of Bow Church. The pinnacle of his fame is St. Paul's Cathedral, whose dome is one of the finest in Europe. The interior of St. Paul's has the lofty, rather heavy grandeur of a Renaissance church. Many of Wren's churches were wrecked by German bombs in World War II.

To think of the work Wren accomplished before he died, at the age of ninety-one, is to be amazed! Fifty-four churches, eight colleges, thirty-five halls of various kinds, four palaces, in part and whole, and about fifty other works of varying importance, such is his record. When the giant died he had, like Michelangelo, many followers, none of whom could in any way measure forces with him. For now the true Renaissance had risen to its height and was sinking.

EIGHTEENTH-CENTURY ARCHITECTURE IS SOUND AND PLEASING

There was in England during the early part of the eighteenth century a widespread interest in architecture. The reconstruction of the city by Wren had stirred not only the architects, masons and carpenters employed, but all the society of London. When Queen Anne passed an act for the building of another fifty churches in 1711, this interest grew. The erection of private houses became the fashion. Everybody who could afford it must have a new house built in what was left of the Renaissance style. Nothing was produced save on Italian lines, and although no buildings arose that even faintly rivaled the creations of Inigo Jones and Wren, most of the architecture of the eighteenth century was sound in construction and pleasing in appearance.

A great many names are connected with the century: John Vanbrugh (1664–1726), whose best-known works are large country mansions like Castle Howard and Blenheim Palace; Nicholas Hawksmoor, who was at various times assistant to Wren and Vanbrugh, and whose St. George's, Bloomsbury, Renaissance style, is one of the finest in London; the Adam brothers, whose buildings left a stamp on London and whose doorways and fireplaces are very striking; and William Chambers, who built Somerset House.

THE GOTHIC AND CLASSIC REVIVALS IN ENGLAND

During the first half of the nineteenth century the architecture of England was passing through a state of chaos owing to what are now called the Gothic and classic revivals. The interest of the country was divided between these two styles, and an enormous amount of building was done which lacked the dignity of the eighteenth-century architecture, its quietness, its comeliness, its "Englishness."

It is always a bad sign in the history of a country's architecture when men go back to a remote period and slavishly copy it instead of adapting its principles to the needs, climate and social life of their own country. St. George's Hall, Liverpool, is described as the most perfect design of the classic revival, but because of the climate it is hopelessly wrong. The classic halls and temples of Greece and Rome were constructed of shining white marble and stood under deep blue skies, gleaming in the clear air. Every plain clear-cut line had its full value: there was no need to peer in the gloom to see where the pillar began and the shadow ended. In London the Royal Exchange, the British Museum, the National Gallery, the Athenæum Club are all outstanding examples of the classic revival.

The Houses of Parliament are by far the best work of the Gothic revival. A great many of the well-known and much-loved buildings of London have already been mentioned in our story of Great Builders of London. In other parts of England the nineteenth century saw the setting-up of a tremendous array of buildings: the Scottish National Portrait Gallery, by Sir Rowand Anderson; the Rylands Library at Manchester, by Basil Champneys, who also built Girton and Newnham Colleges, Cambridge; St. Mary's Cathedral, Edinburgh, by Sir Gilbert Scott the elder.

MODERN ARCHITECTURE IN ENGLAND

As the nineteenth century drew toward its end these fashions in architecture died out. Men began to think again of Inigo Jones and Wren, who had adapted Renaissance ideas and made something English of them. This harking-back to their own two great geniuses was the beginning of a really fine thing—modern English architecture, which is not a slavish imitation of any one style and is slowly developing into something which will presently belong in spirit to England alone.

One of the most notable pioneers of this modern architecture was R. Norman Shaw, R.A., who lived from 1831 to 1912. His earliest building of note was the New Zealand Chambers in Leadenhall Street, then the Gaiety Theatre, the Piccadilly Hotel and the New Scotland Yard.

The New War Office by William Young and the College of Science by Sir Aston Webb are notable new buildings in the new manner. Liverpool will make the century famous with its magnificent new Cathedral of the Church of Christ by Sir Giles Gilbert Scott. In various parts of England a number of very beautiful country houses have been built by Sir Edwin Lutyens, who also designed the Cenotaph in Whitehall. This great architect has also left his stamp most magnificently on modern Delhi, India, by the government buildings there, and on Johannesburg, South Africa, by the imposing Art Gallery.

THE DEVELOPMENT OF THE CHATEAUX OF FRANCE

The Gothic builders of France not only erected the cathedrals which are the country's glory and pride, they set up also a number of castles and private palaces. These are generally known as châteaux, and they passed through the same developments as the English castle.

The earliest were built by powerful princes and kings. When the feudal system died out and private individuals, through industry and trade, grew to power, some very fine houses were built for them. As in the case of the English halls, varying periods have set their mark on these great homes of France.

Many of these were destroyed in the Revolution, others fell into ruin during the course of years. One of the earliest and most famous was carefully restored by Viollet-le-Duc, a clever architect of nineteenth-century France, and is now open to the public. This is the Château de Pierrefonds near Compiègne, in northern France. It was built by Louis of Orleans about 1396 on a rocky height above the village, and gives us to-day an excellent idea of what a French medieval castle was like.

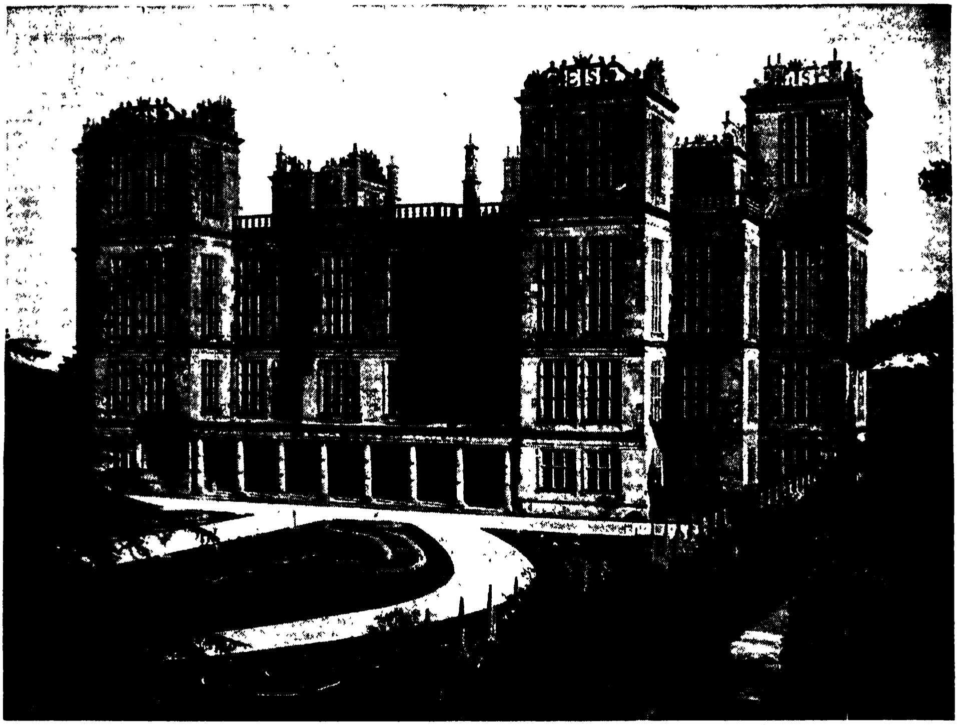
Pierrefonds is foursquare in shape, surrounded by an immense battlemented wall twenty feet thick which rises sheer from the rock; eight loopholed towers 115 feet high are built into the wall, one at each corner and in the centre of each side. Within this enormous mass of protecting masonry lie the buildings of the castle, grouped round a courtyard.

For two hundred years Pierrefonds was a powerful fortress. We can imagine the castle, with its moat and drawbridge and fortified towers, rearing itself above the surrounding country, a menace to enemy forces, a symbol of pride and power. Early in the seventeenth century it was dismantled. During the Revolution it was sold, and bought later by Napoleon. It now belongs to the French nation.

IN RURAL ENGLAND

Waddesdon Manor in Buckinghamshire.

Wren's Orangery in Kensington Gardens.



Hardwick Hall in Derbyshire, built at the end of the sixteenth century.

Old Almshouses at Haslemere, in Surrey.

The Quadrangle of Eton College.

The walled towns of France give us another glimpse of medieval Europe. We can trace the course of the country's history by the ruins of monstrous walls that still stand around certain towns. The ramparts of Dinan and St. Malo in the north draw the eye and mind of the holiday-maker into another world. In the south of France are three of the most remarkable walled towns in Europe: Avignon, Carcassonne and Aigues Mortes.

THE HISTORIC OLD BRIDGE ACROSS THE RHONE AT AVIGNON

Within the ramparts and towers that girdle Avignon rises the magnificent palace built by the popes during their residence in France from 1309 to 1377. Part of the famous bridge across the Rhone, the Pont Saint-Bénézet, still stands. It is a wonderful piece of architecture, first built about 1177 by the Guild of Bridge-builders to connect the old town with the new. Built on to one of the piers, halfway across the river, stands the little chapel of Bénézet, the patron saint of the bridge. One of the most popular children's songs in France is written around the structure:

> Sur le pont d'Avignon
> Tout le monde y danse en rond.

We can see more of the grimness of this forgotten architecture in the walls of Carcassonne and Aigues Mortes.

HOUSES THAT CHANGED THEIR CHARACTER THROUGH THE CENTURIES

There are many fortress castles in France which threw off their warlikeness in later centuries and kept nothing of the ancient château but its name. The most beautiful are in the Loire district, and they display some exquisite features of early French domestic architecture, such as the ornamented gateways and the spiral staircases.

The Château de Josselin, in Brittany, dates from the twelfth century, but was rebuilt about four hundred years later in the most picturesque period of the French development. To this period also (early sixteenth century) belongs the Château de Bury, with its large square court, its many-towered entrance. This château is typical of many country houses of the transition period when Gothic was changing into Renaissance. Another famous building is the Château de Chambord, on the Loire. It is massed round two rectangular courts, one within another. All that was rich and elegant of the period in design, masonry and sculpture is to be found in this château. Its carved turrets, chimneys and dormer roofs cluster behind the immense outer walls and barricading towers. At Chambord is one of the corkscrew staircases popular in this period. It is a curious double stair, and is so constructed that people can ascend and descend at the same time without being visible to each other.

ONE OF THE MOST FAMOUS COUNTRY PALACES IN THE WORLD

Other well-known country houses are the châteaux of Chenonceaux, Azay-le-Rideau, St. Germain-en-Laye. The Luxembourg was built, a little later, for Marie de Medici, the wife of Henry IV, by De Brosse. This is different from other such buildings because Marie wanted to pretend that, though living in Paris, she had a home something like the Medici palace in Florence. Hence the grand, Tuscan air of the Luxembourg. A little later still came buildings like the Château de Maison-Laffitte, country houses where a gentleman could receive his guests in state.

Among all these the Château de Blois stands out as one of the most famous country palaces in the world. Its various buildings are grouped round an irregular courtyard, and show where the builders of the thirteenth, fifteenth, sixteenth and seventeenth centuries were employed. It has dormer windows with lovely carved roofs; elegant cornices run along the façades. Here Italian art mixes most curiously with Gothic, after the fantastic shapes of the early Renaissance, and we get the cold stateliness of its full expression. Inside, the fireplaces, panelings, woodcarvings and statuary show the treasures of a country rich in art.

The most famous details of Blois are the entrance built for Louis XII, and the staircase, designed, it is said, by Leonardo da Vinci for Francis I. The staircase winds up through a five-sided tower which projects from the face of the wall. The tower is open at each story, and the stair's marvelous repeated curves are visible from the courtyard.

Another type of dwelling arose in the Gothic years in France, during the period when merchant princes and private individuals built what we should call town houses and they called hôtels. One of the finest in Europe is the Hôtel Cluny in Paris, now a museum. It was the town house of the abbots of Cluny, and stands as a fine specimen of late Gothic architecture in France. Other famous buildings are the Hôtel de Bourgthéroulde in Rouen, Hôtel de Sully in Paris, Hôtel de Sens, the House of Jacques Cœur in Bourges, the house of Agnes Sorel in Orléans.

To this period also belong the magnificent municipal halls that mark the rising of a city's wealth and strength. Among them are the hôtels de ville (town halls) of Arras, of Compiègne, Bourges, Dreux, St. Quentin. Then there are the Palais de Justice (Law Courts) of Rouen and Beauvais; beautiful monuments of a forgotten architecture like the Maison-Dieu, or Hôtel-Dieu (hospital), at Beaune. There have been many later municipal buildings set up, such as the Hôtel de Ville at Lyons, an ornate Renaissance structure, but nothing will ever bring back to France the beauty, the "other-world" quality, of the Gothic domestic and municipal buildings.

The Renaissance was brought to Paris by the first king of a consolidated France, Francis I, who reigned from 1515 to 1547. He loved art and letters, had a brilliant court, and set an example to his courtiers in building and in cherishing beautiful things. Behind the king, influencing him, helping him, was that wonderful woman, his sister, Margaret of Navarre.

A great army of Italian artists and architects came and settled in Paris. The first mood of the Renaissance showed in the grafting of Italian details on the French Gothic. The severe classical lines of Italian Renaissance work were long in appearing—about a hundred years. The northern French clung to the pointed sky-line of the Gothic style they loved. As in Italy, the Renaissance came more fully to growth in the parts where Gothic architecture had never been deeply rooted; where the old Romanesque had lingered the Renaissance blossomed most freely.

THE SPLENDID MONUMENT TO THE ENTHUSIASM OF A KING

The favorite home of Francis I was the Château of Fontainebleau, which he built just outside Paris. Here a kind of school of art and architecture gathered, with artists and architects like Primaticcio, Philibert de l'Orme, Jean Bullant and Pierre Lescot to the fore.

Yet Fontainebleau as a château is not nearly so fine as Blois or Chambord. Its interest lies more in the superb lay-out of the grounds, the formal gardens, terraces and lakes, and in the details of the buildings: the porticoes, staircases and marvelous internal decoration by artists like Benvenuto Cellini and Primaticcio. The château was originally designed by Gilles le Breton. Vignola and Serlio added extensions later which were admirable in themselves but marred the harmony of the whole.

THE EARLY FRENCH ARCHITECTURE OF THE RENAISSANCE

The period of the Fontainebleau school marks the beginning of the real French architecture of the Renaissance, and also marks the end of the happy-go-lucky style of building which, adding line on line and stone on stone, had produced the medieval treasures of France.

The life and work of Philibert de l'Orme marks the cleavage between the old and the new. He was fully aware that the old genius of the master builders was gone; that the new style of buildings coming with the Renaissance needed another kind of knowledge, of technique. After De l'Orme, architects, as we understand them, working to plan, to measured drawings, became the builders of France.

It has been said that the art in which France has always rendered her most brilliant service to the world is the art of architecture. In the Palais du Louvre in Paris, known the world over now as "The Louvre," we can see the development of this art. The Palace, rebuilt on the site of an older palace, was begun in the reign of Francis I; it has been completed within the memory of your grandfathers. Thus some four hundred years have gone to the building and adorning of this pile, which is the masterpiece of Renaissance architecture in France.

THE AMAZING HOUSE WHICH WAS TO COVER FORTY-FIVE ACRES

The Louvre, together with the Palace of the Tuileries, to which it was long intended that the Louvre should be joined by means of a gallery, made together a truly imposing royal residence, covering forty-five acres. Even without the Tuileries—which was destroyed in 1871 by the Paris Communists—the Louvre stands as a stupendous piece of architecture, with its various pavilions and its courts.

When Pierre Lescot began, at the

orders of Francis I, a new palace which should take the place of the Gothic Louvre of his forbears, he was doing more for the Paris of to-day than he could possibly know. His work was in the early Renaissance spirit and of beautiful dignity; the rest of the architects, who followed his lead, worked naturally according to the ideas of their own period, but seemed to agree to depart as little as possible from the ideals of Lescot. Jean Goujon, the sculptor, made the decorations for Lescot's façade; his labors and his genius are made forever memorable in "Jean Goujon's door." Catherine de Medici carried on Lescot's original idea, and planned along the Louvre the connecting gallery with the Tuileries, a scheme taken up about three hundred years later.

Henry IV set Du Cerceau, the architect, to work on the Louvre in the early years of the seventeenth century. Du Cerceau's work was largely lost in the alterations made by Napoleon III from 1860 to 1865. Next, Louis XIII and Cardinal Richelieu set to work, with Lemercier as architect, who began about 1625 the large court of the Louvre. His labors are best remembered by the Pavillon de l'Horloge in the middle of the west façade.

The next in this interesting procession of kings who loved building is Louis XIV, with Cardinal Mazarin and Colbert, the great minister. These first set Le Van to work about 1650 to finish the court Lemercier had begun, then ordered Claude Perrault, the court physician, to design the long eastern façade, 600 feet long. By this time the pure French early Renaissance spirit had been lost in a Slavish imitation of Italian architecture. Colbert and his master Louis XIV had called in all the Italian artists and architects they could. Bernini, who planned the great piazza of St. Peter's in Rome, was summoned to Paris to give designs for this very part that Perrault built.

ART SWALLOWED UP IN FLATTERY IN THE PALACE OF VERSAILLES

Presently Louis XIV turned his attention to the building of Versailles, a pleasure palace where the glory and greatness of Louis could be extolled and his name carried down to farthest posterity. Versailles is, on the whole, a very uninspired building, whose chief architects, Le Van and Mansard, imitated the Italian Renaissance without succeeding in catching its greatness, and, absorbed in this imitation, forgot the excellent teachers they had in their own French Renaissance masters. The interior of Versailles was given up to mirroring the grandeur of Louis; art was swallowed up in flattery. Incredible sums of money were lavished on this palace.

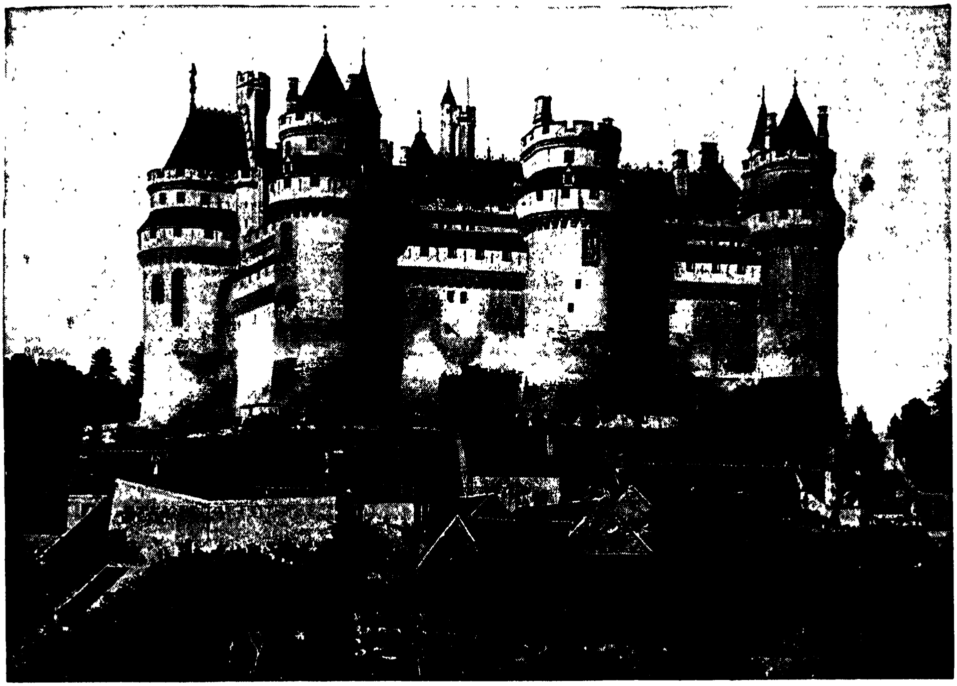
The Petit Trianon, a country house for one of the court favorites, was set up at Versailles during the next reign, in a rather happier manner; this little palace becoming the favorite residence of the ill-fated Marie Antoinette.

From toward the end of the seventeenth century till after the Revolution little more was done to the unfinished Louvre. Napoleon I set Percier and Fontaine to work there. They planned and began the connection with the Tuileries which Catherine de Medici had wanted. Napoleon III carried on this idea, the work being in the hands of Lefuel and Visconti about 1850. These two built the "New Louvre"—the part close to the Tuileries. Lefuel was laboring at other parts of the great pile from 1860 to 1878. In the meantime the Palace of the Tuileries had been destroyed. The outer arm of the Louvre, which was to touch it, was therefore rendered somewhat meaningless. All that is left of the Tuileries is a piece of the façade, in the Tuileries garden.

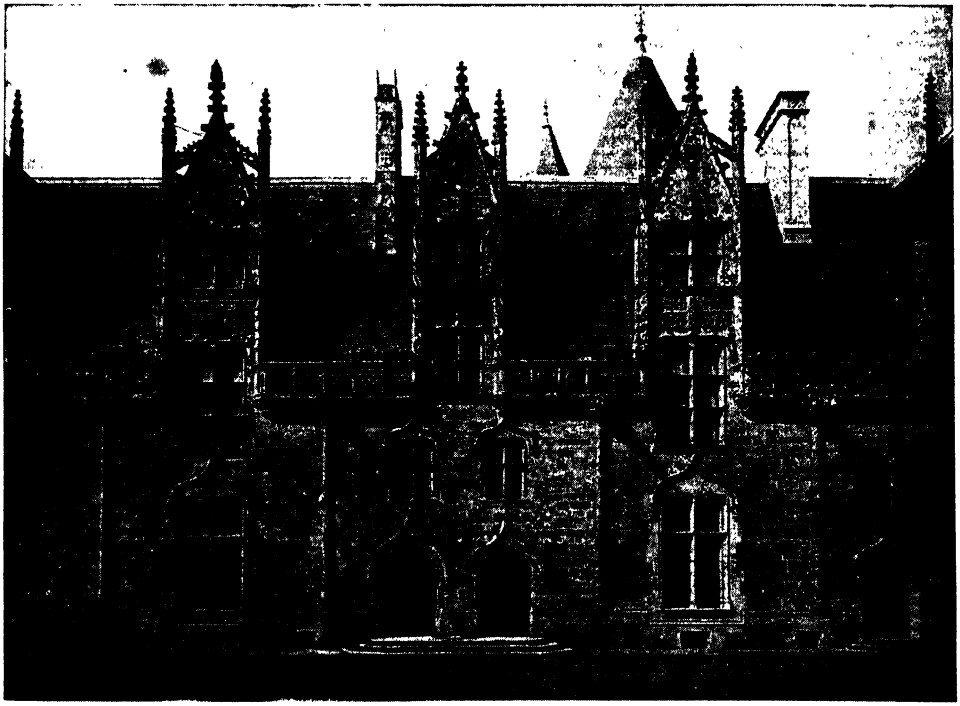
THE GREAT DOMES WHICH REPLACED GOTHIC SPIRES AND TOWERS

The Renaissance in France changed the face of the country as completely as Wren's churches changed the face of the city of London. Where the Gothic spires and towers had dominated the sky-line, presently rose up the huge domes that were the chief feature of the new sacred buildings. At first past and present were curiously mixed, as in the churches of St. Eustache and St. Etienne du Mont in Paris. They were built about 1532. It is very interesting to see these structures built on medieval lines, with flying buttresses and rounded apses, bearing the unmistakable stamp of the Renaissance in their decoration and wall treatment.

Lemercier, the architect of St. Eustache, also designed the Church of the Sorbonne, which was built about a hundred years later. It has the usual classic front and the dome of the Renaissance church. St.



THE NORTH FRONT OF THE CHATEAU OF PIERREFONDS, IN FRANCE



THE CHATEAU OF JOSSELIN, IN FRANCE, WITH ITS QUAINT DORMER WINDOWS

Sulpice, Val de Grâce, St. Paul, and St. Louis were built about the same time as the Sorbonne. Here, in the latter church, the Baroque style is creeping in, with its curves and florid ornamentation. The Church of the Val de Grâce was built by Mansard, St. Sulpice by Le Van, the two chief architects of Versailles. St. Sulpice is an immense church, with eighteen chapels. Its wonderful pillared façade was added by Servandoni.

Mansard also built the dome of the Church of the Invalides—one of the finest domes in Europe. In 1755 the Panthéon rose, as if to crown the labors of the Renaissance movement in France, but the dome is not so fine as that of the Invalides, built a hundred years earlier.

THE CLASSIC REVIVAL IN FRANCE FOLLOWS THE ROCOCO STYLE

With the decline of the Renaissance spirit in architecture France fell into the overdecorated Rococo style. But French taste would not long tolerate this, and there was a classic revival under Louis XV when Roman architecture was very closely followed. In the Panthéon, the greatest ecclesiastical monument of the time in France, exterior and interior are both classically treated. In shape a Greek cross, it has a dome 265 feet high and an imposing portico of colossal Corinthian columns. The Grand Théâtre at Bordeaux was another product of this movement.

Under Napoleon many buildings in the Roman style appear: the Arc de Triomphe du Carrousel behind the Tuileries, the Arc de l'Etoile in the Champs Elysées, and the Church of the Madeleine were all designed, by the emperor's wish, in a style as Roman as the needs of each would permit.

The Greek revival took little hold on France, and has but one notable monument, the Church of St. Vincent de Paul, by Hittorff.

A Gothic movement began about 1845 and, though it produced few notable buildings, was responsible for the restoration of medieval monuments like the Château de Pierrefonds, of which we have already spoken.

The reign of Napoleon III was a period of great activity, particularly in Paris, where the Louvre and the Tuileries were finished and the New Opera was constructed. This is by far the most sumptuous building for amusement in existence. To this reign belong also the Palais de l'Industrie, built for the exhibition of 1855, and several great railway stations (Gare du Nord, Gare de l'Est, and others). In these the modern French version of the Renaissance was applied skillfully to buildings made largely of iron and glass. Napoleon III also added splendid new avenues and squares to the city of Paris.

After the Franco-Prussian War a number of important structures were erected —not original in style but marked by refined taste and good planning.

THE SPREAD OF THE RENAISSANCE INTO THE SMALLER COUNTRIES

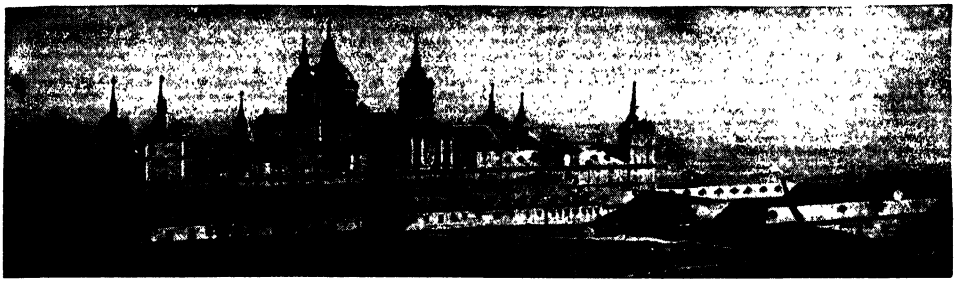
The Renáissance found its way into the smaller countries of Europe, and while the marvels of the Louvre, and the Invalides, and châteaux like Chambord were rousing the enthusiasm of the French and being influenced by French art, a number of buildings were rising in the Low Countries of the Rhine lands and being equally influenced by the art already existing there. It seems natural that French Renaissance buildings should have their own distinction, due to the exquisite taste and refinement of the French peoples, and that the Belgian, Dutch and German Renaissance buildings should have their difference rather than distinction, due to the florid and less refined tastes of the peoples concerned. Dignified and restrained architecture of the Renaissance at its best, as in the Louvre, or parts of Greenwich Hospital, could have no hold in countries whose natural tastes led them to like more ornament, more twists and curves, and much decoration.

PERSISTENT GOTHIC FEATURES IN THE RENAISSANCE BUILDINGS OF GERMANY

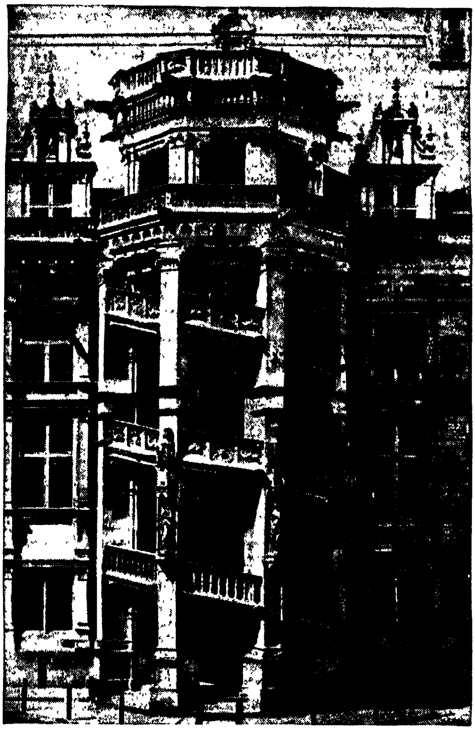
East of the French border the masterpiece of the Renaissance is Heidelberg Castle as shown in the parts built between 1531 and 1612. In spite of its period the castle is more Gothic and medieval in spirit than anything else. It is an interesting array of halls and wings grouped about an open space, with the great watchtower dominating the whole mass. It seems that the builders of the varying periods set up an even sky-line only under protest. They loved the broken-up Gothic shapes much more than a horizontal, classical contour.

How much the steep Gothic roofs were beloved in Germany we can see from

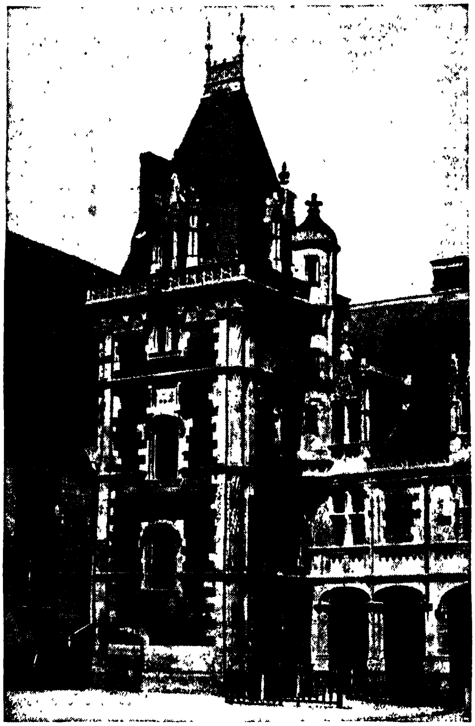
FORTRESS-PALACES AND LOIRE CHATEAU



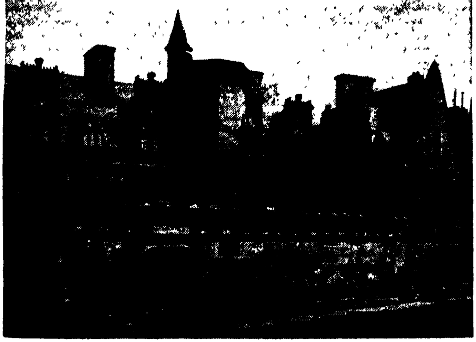
The Escurial, the great palace and monastery near Madrid.



The famous spiral staircase at Blois.



An entrance to the Château of Blois.



The beautiful Cluny Museum in Paris.

The Palace of the Popes at Avignon.

their old houses in Nuremberg, and at Hildesheim, in Hanover. The builders clung to this style when the Renaissance was telling them to feel differently: hence buildings like the Rathaus in Altenburg, the Rathaus in Heilbronn, the Pellerhaus in Nuremberg, the Gewandhaus in Brunswick. The sixteenth-century Stuttgart Castle and the Zwinger Palace in Dresden, built in 1711, show a good deal of the picturesqueness of German Renaissance.

A number of public buildings, mainly town halls, were set up in this period in the Netherlands, and to many existing Gothic piles Renaissance additions were made, as in the town halls of Ghent, Delft and Haarlem. The charming little Town Hall of Ypres was shattered under the German guns in the World War, like so many other Belgian monuments of the Renaissance. The Hôtel de Ville in Antwerp is a sturdy, well-built pile with a façade over three hundred feet long and a richly decorated centre pavilion. The sixteenth-century Town Hall of Amsterdam is supposed to be the best in Holland.

THE NEW STYLE OF CHURCHES WHICH AROSE IN EUROPE

The guild houses of Brussels and Antwerp form another group of Renaissance buildings as interesting in character as in history. Other little monuments of this period which we should not forget are the Maison de l'Ancien Greffe, now part of the Law Courts of Bruges, and the Musée Plantin in Antwerp, which was built in 1550 for a merchant and later used as a printing works.

The Catholic reaction against the Reformation was responsible for a sudden zeal in church-building, led mainly by the Jesuits. The general spirit of the new erections was Baroque or Rococo, which, we remember, was the last exuberance of the Renaissance style. Europe was dotted with these new churches.

Several of them rose in the Catholic parts of Belgium in the seventeenth century. Protestant Holland and Germany would have little to do with them. St. Michel in Louvain is an example of this late Renaissance style. There are many such churches in Antwerp, Bruges, Namur and Brussels.

The churches that were erected in Germany during the sixteenth, seventeenth and eighteenth centuries are curious blends of all styles, Gothic and Renaissance and classical being sometimes mixed up in one church. Buildings like the Marienkirche in Wolfenbüttel, the church in Buckeburg, St. Michael in Munich, Salzburg Cathedral, and the Neumünster in Würzburg are interesting revelations of a peculiar taste, but they cannot be called great architecture: they are overdecorated, and lack dignity and restraint.

THE REMARKABLE BUILDING DESIGNED BY MICHELANGELO'S PUPIL

Baroque architecture was a little more at home in Spain than in Northwestern Europe, the country being already saturated with the rich extravagances of Moorish art. Both early and late Renaissance in that country produced interesting buildings of a free and fanciful type. Between these two periods was a spell when for about a hundred years architects who loved ancient Rome tried to graft a classical style on Spanish architecture. The most important architect of this middle period was Juan de Herrera, a pupil of Michelangelo.

Herrera was the chief designer of one of the most famous piles in the world—the Escurial, some thirty miles from Madrid. This group, begun in 1563, was not completed until nearly 150 years later. It includes monastery, college, church and palace. Philip II, for whom the Escurial was built, loved the great austere mass of yellowish gray granite, and inside its severe walls perhaps found peace.

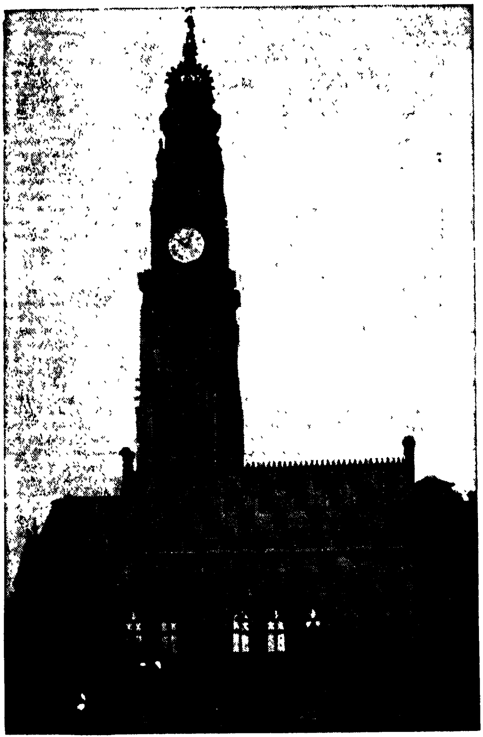
Herrera allowed himself most wisely to be dictated to by the material he was using and by the site. These masses of granite rising up on the sun-bleached, lovely land must not be trimmed or decorated, must heave themselves up as if Nature had flung them there. Hence the remote, grand look of the Escurial seen for the first time from a distance, with its long unbroken walls and corner turrets, the high central dome and towers of the church. Herrera designed many other buildings, including the Casa Lonja in Seville and the unfinished Valladolid Cathedral. But nothing else in Spain shared the magnificent austerity, the sobriety, of the Escurial.

BEAUTIFUL STONEWORK THAT VIED WITH THE SILVERSMITH'S ART

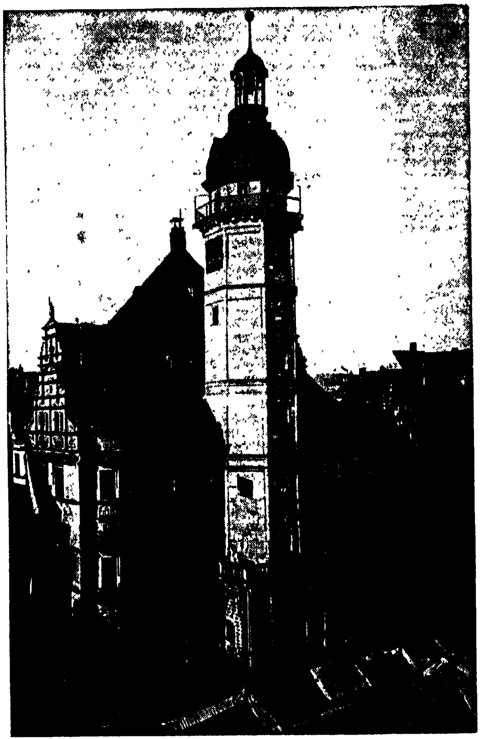
Before and after the period that saw the Escurial built a great many rich and fantastic palaces and churches rose in

THE RENAISSANCE IN NORTHERN EUROPE

The beautiful Château of Versailles near Paris.

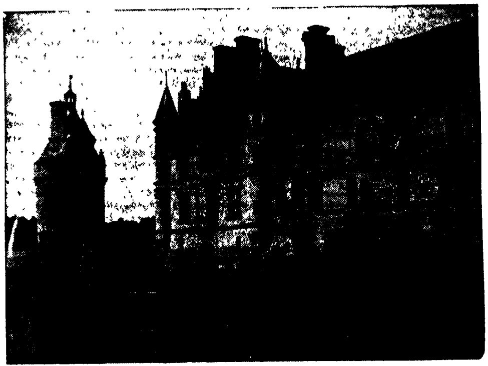


The Town Hall of Arras as it was before the World War.



The Rathaus, or Town Hall, at Altenburg, in Germany.

The Rathaus at Heilbronn, in Germany.



The Chateau of Chenonceaux, in France.

the peninsula. The earlier period is the more charming, where Moorish, Gothic and Renaissance styles mingle in any one of many buildings.

The kind of decoration achieved was so rich and fanciful and beautifully finished, and seemed so like a metal-beater's or silversmith's work, but in stone, that it was given the name Plateresque—from *platero,* "silversmith." This peculiar beauty can be seen in the Casa de Ayuntamiento in Seville, the Casa de la Conchas in Salamanca, the Casa de Miranda in Burgos.

During this time, the early sixteenth century, most interesting additions were made to the Alcazar at Toledo in the form of new façades to the old Moorish-Gothic granite castle. The best example of early Renaissance secular architecture in Spain is the palace of Charles V at Granada, built to adjoin the Moorish Alhambra. Here a square mass of building in golden-colored stone, inset with tinted marble, is set about an open circular court. Round the court runs a fine colonnade of Doric and Ionic columns.

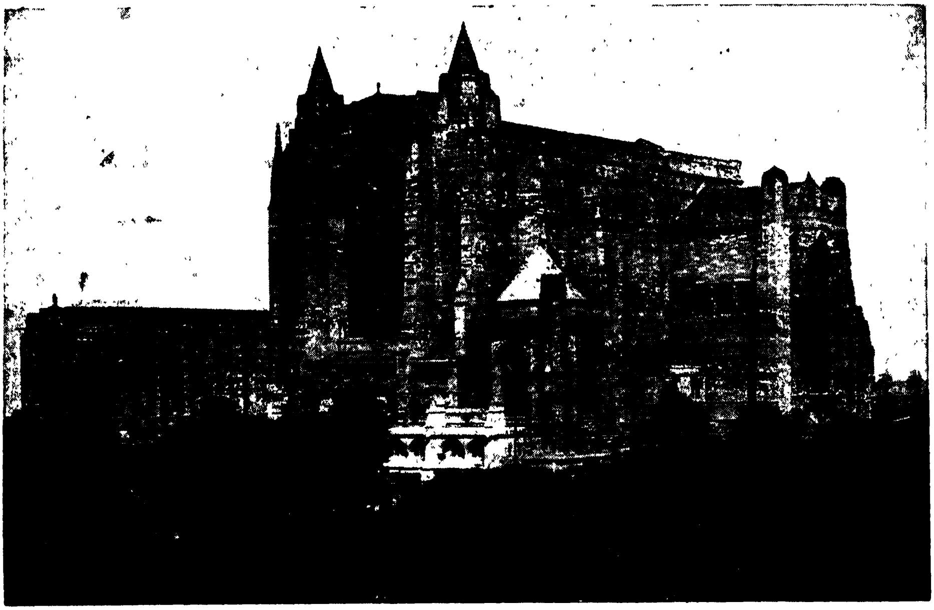
Granada Cathedral is the finest religious expression of the Renaissance in southern Spain. It was begun by Diego de Siloë in 1529 in memory of the triumphs of Ferdinand and Isabella, and though unfinished, it is a most magnificent pile. St. Estéban, Salamanca, built about the same time, more in the Plateresque style, is a charming combination of Gothic, Moorish and Renaissance art. Jaen Cathedral and Malaga Cathedral belong to the same period and are very beautiful.

SPAIN AS THE HOME OF LOST CAUSES IN ART

Later on, in 1677, came Nuestra Señora del Pilar, Saragossa; and a hundred years later still, St. Francesco in Madrid, a domed church which was intended to be a great tomb-house of the famous men of Spain.

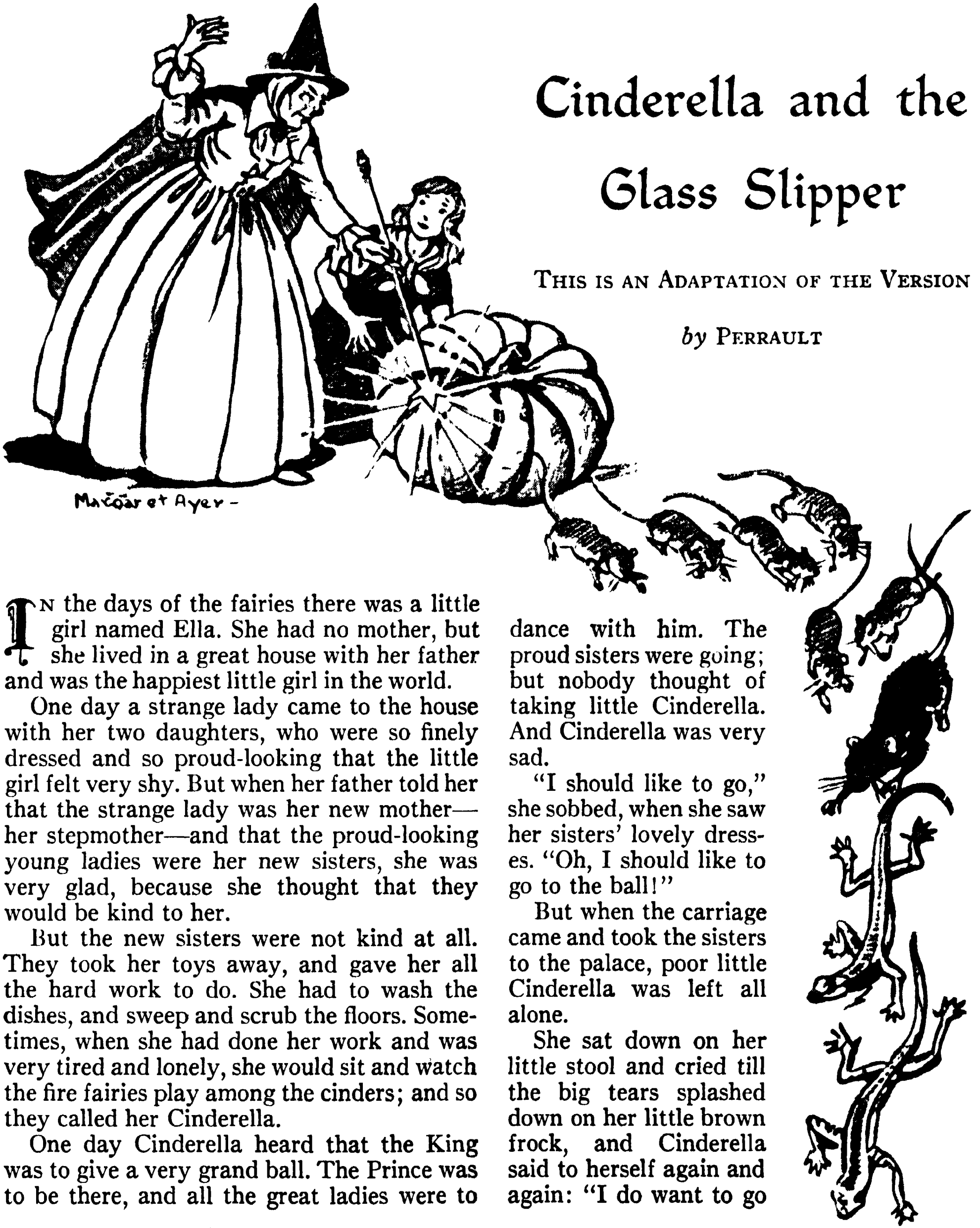
In her architecture of the varying periods Spain could not help enriching all that she borrowed from other countries. Her builders were peculiarly gifted in their ability to pile on ornament without making their architecture florid; to make innovations which are so successful that one wonders why they were not made elsewhere.

The truth probably is that, where all art is concerned, Spain is a land of genius. And at the same time, where architecture is in question, Spain may be called the home of lost causes. So much was triumphantly begun and never finished; so much has fallen into ruin and lies in ruins where it fell.



LIVERPOOL CATHEDRAL, BUILT BY SIR GILES GILBERT SCOTT

THE NEXT STORY OF THE FINE ARTS IS ON PAGE 6679.



Cinderella and the Glass Slipper

THIS IS AN ADAPTATION OF THE VERSION

by PERRAULT

In the days of the fairies there was a little girl named Ella. She had no mother, but she lived in a great house with her father and was the happiest little girl in the world.

One day a strange lady came to the house with her two daughters, who were so finely dressed and so proud-looking that the little girl felt very shy. But when her father told her that the strange lady was her new mother—her stepmother—and that the proud-looking young ladies were her new sisters, she was very glad, because she thought that they would be kind to her.

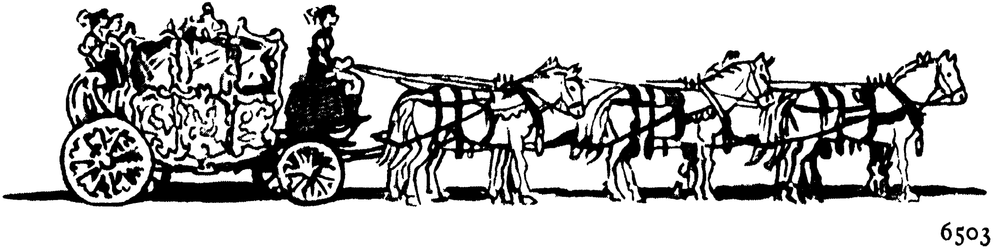
But the new sisters were not kind at all. They took her toys away, and gave her all the hard work to do. She had to wash the dishes, and sweep and scrub the floors. Sometimes, when she had done her work and was very tired and lonely, she would sit and watch the fire fairies play among the cinders; and so they called her Cinderella.

One day Cinderella heard that the King was to give a very grand ball. The Prince was to be there, and all the great ladies were to dance with him. The proud sisters were going; but nobody thought of taking little Cinderella. And Cinderella was very sad.

"I should like to go," she sobbed, when she saw her sisters' lovely dresses. "Oh, I should like to go to the ball!"

But when the carriage came and took the sisters to the palace, poor little Cinderella was left all alone.

She sat down on her little stool and cried till the big tears splashed down on her little brown frock, and Cinderella said to herself again and again: "I do want to go



—I do want to go to the ball."

Then suddenly came a voice.

"And you shall go," said somebody.

Cinderella looked up, and there, standing at her side, was a fairy.

"I am your fairy godmother," she said. "Now, if you do just as I tell you, and ask no questions, you shall see what I can do."

She kissed Cinderella and wiped away her tears.

"First of all, you must fetch me a pumpkin," she said.

Cinderella ran into the garden, and brought the largest pumpkin she could find. The fairy godmother bent down and touched it with her wand, and suddenly, as quick as lightning, the pumpkin was turned into the grandest coach Cinderella had ever seen, with blue velvet seats and silver doors.

"Now I want a mouse trap," said her godmother.

Away ran Cinderella, and when she brought the mouse trap, with six mice in it, the fairy touched that, too. Suddenly, in a minute, the six wee little mice that were squeaking inside were changed into six prancing white horses.

"And now," said the fairy, "bring me the rat trap and two lizards."

Cinderella brought them, and the fairy turned the rat into a coachman and the lizards into two dignified footmen.

Cinderella clapped her hands for joy, and did not know what to do because she was so happy.

"Shut your eyes!" cried the fairy.

Cinderella shut her eyes tight, and when she opened them again she found that she had on a beautiful frock, prettier than any she had ever seen, and on her feet were two little glass slippers. Then the fairy opened the door of the coach.

"Jump in," she cried, "and drive away to the ball! But remember one thing. Remember that *you must be home before the clock strikes twelve.* Promise me that you will obey me. Promise that you will do exactly as I say."

Cinderella promised, and drove off to the ball. When she got to the palace, who should come to meet her but the Prince himself. His coat was of blue satin, and at his side hung a beautiful sword with sparkling hilt. Taking Cinderella's hand, he led her into the ballroom, and everybody left off dancing to look at the Prince and the beautiful strange maiden whose name nobody could guess.

Cinderella enjoyed dancing with the Prince so much that she forgot all about the time and about her fairy godmother, until she caught sight of the clock. It was just going to strike twelve, and Cinderella became so frightened that she jumped up quickly and ran as fast as she could go, through the ballroom and down the stairs. One of her pretty little glass slippers fell off on the stairs, but she could not stop to pick it up. On she ran, past the tall footmen, and as she

Cinderella saw that the clock was about to strike twelve.

reached the palace door the clock struck twelve.

Cinderella trembled, and ran out into the street, but, alas! the coach and horses had vanished. She looked at herself and found that her pretty dress had vanished too, and the little brown frock was there instead.

Poor little heartbroken Cinderella cried all the way home, and when the sisters came back from the ball they found her sobbing on the cold hearth among the cinders.

The next day the King's messenger went round the city blowing a silver trumpet, and all the people came out to listen. He said the Prince had found a glass slipper which belonged to a beautiful lady with whom he had danced at the ball. No one knew who she was, but she was so gentle and sweet that the Prince had fallen in love with her, and he said that if only they could find her he would marry the lady who owned the glass slipper.

All the ladies of the land came to try on this wonderful glass slipper, but it was so tiny that none of them could wear it. At last the messenger came to the house where Cinderella lived. The stepsisters became so excited, and were so anxious to try on the slipper, that they could hardly wait to unfasten their shoes, and had to call for Cinderella's help. But when Cinderella saw the slipper she knew it at once. It was her shoe which had slipped off at the ball when the clock struck twelve.

The two sisters tried and tried, but the shoe would not go on.

"Please let me try it on," said Cinderella.

"You!" cried the sisters, pushing her away. "As if a kitchen maid could wear such a dainty shoe!"

But the King's messenger put out his hand and helped Cinderella into the chair. She took off her old shoe and put out her foot, and in a second the wonderful slipper was on. It fitted perfectly.

Suddenly there was a sound like a rushing wind, and in a moment the fairy godmother appeared and with a touch of her wand Cinderella was a grand lady again, clad in all her ballroom finery.

She stepped into the coach which was waiting for her at the door and drove away with the messenger to the palace where the Prince met her and made her his bride.

In a second the slipper was on. It fitted perfectly.

The Prince's Five Servants

MANY, many years ago there lived a beautiful Princess, who was so charming that everyone loved her. But she had a cruel mother, who never seemed happy unless she was making others miserable. So the Princess eagerly looked forward to the day when some brave Prince would fall in love with her, and take her away to a home of her own. Alas! no sooner did a suitor appear than the old Queen set him, as the price of her daughter's hand, some impossible task, on the understanding that failure should mean death; and so the poor man lost not only his bride, but his head as well.

One day when the Princess was walking in the forest with her maids, a handsome Prince rode by.

"What a lovely girl!" thought the Prince; and he watched her till she passed out of sight.

Now, the Prince had fallen in love with the Princess at first sight, and he determined to win her. He set out the next day for the palace. On the outskirts of a wood, through which he had to pass on his way, he noticed what he thought to be a huge beast lying by the wayside. But, on going nearer, he found that it was no beast, but a man—the biggest man he had ever seen.

He touched him on the shoulder, and the man stood up and asked: "Do you need a servant?"

"If I did," returned the Prince, "I don't know what I should do with such a great fat fellow as you."

"What does my size matter," answered the man, "so long as I discharge my duties faithfully?"

This answer pleased the Prince so much that he engaged the man on the spot. When they had gone along a little farther, the Prince came across a man who lay on the grass with his ear close to the ground.

"What are you doing?" asked the Prince.

"Listening," said the man. "I can hear all that goes on in the world."

"You may be valuable to me some day," said the Prince. "Follow me."

Before they had gone very far they came across a pair of feet, and, a little farther on, a pair of legs; and then they found a body; and then, at last, the head.

"Bless me," exclaimed the Prince, "what an extraordinary man!"

"Oh, replied the man, "this is nothing to what I can do when I stretch myself to my full height! When I choose, I can make myself three times as tall as the highest mountain."

"Follow me," said the Prince. "Some day you may be of service."

Then an extraordinary thing happened. The man muttered some words and in an instant he shrank to the size of an ordinary man.

This strange little band journeyed on till they came upon a man who shivered with cold, though he sat in the blazing sunshine.

"Are you ill that you shiver in this heat?" inquired the Prince kindly.

"Indeed," answered the man, "something must be wrong with me, for the sun, instead of warming me, sends cold thrills over me; while the cold and ice of winter oppress me so that I often faint as from heat!"

"How very extraordinary!" said the Prince. "Still, as you seem to have nothing to do, follow me, and I will take you into my service."

A little farther on they found a man who was standing on tiptoe, eagerly scanning the land.

"For what are you looking?" asked the Prince.

"I am watching the world," replied the man. "My eyes are so sharp that I can see from end to end. If you need a servant, you may find me very useful."

"True," said the Prince. "Follow me."

When they arrived at the palace, the Prince was brought before the Queen, from whom he begged the hand of the lovely Princess.

"The man who would win her," replied the old Queen, "must earn her."

The Prince was prepared for this, and asked what his task was to be.

"There are three," replied the Queen. "First, bring me the ring that I dropped in the Red Sea."

"Why, there it is!" exclaimed the sharp-eyed man, "just by that green rock." Whereupon the tall man stretched himself to his full length, bent over, and picked it up.

The Queen pretended to be pleased.

"You have indeed done well," said she; "but you may not find your second task so easy. Yonder are a hundred fat oxen: these you must eat before noon."

"May I invite a guest?" asked the Prince.

"Certainly," replied the Queen, with a spiteful laugh. "One, and one only."

The Prince turned and found the fat man

at his side.

"Just leave this to me, Master," said the man, well pleased at the prospect. And by noon nothing remained of the feast but a pile of bones.

This time the Queen could scarcely hide her anger.

"Your third task you may find more difficult to perform," she said. "At sunset I shall bring my daughter to your apartments and leave her in your care. See to it that she is still there when I return at midnight."

"That does not sound impossible," thought the Prince; "with the help of my five servants I think I can manage."

At dusk the Princess arrived. The Prince led her to a low-cushioned seat by the window, and the Queen went away. As the door closed behind her the Prince clapped his hands, and immediately his servants made silent preparations for the watch. The tall man stretched himself to his full length, and wound himself round and round the little house, so that none could go in nor pass out; the sharp-eyed man closely watched the movements of the Queen; while the man with the wonderful hearing remained motionless with his ear to the ground.

Within the room all was silence. The moon streamed through the open window on the face of the lovely Princess, who sat with folded hands gazing idly at the stars; and behind, his face in shadow, stood the Prince watching her exquisite beauty.

Suddenly, as the clock struck eleven, the old Queen threw a spell over them, so that they all fell asleep; and while they slept the Princess vanished. Clever as she was, the old Queen had no powers of enchantment after a quarter to twelve, and as the clock chimed they all awoke, and the Prince started to his feet.

"Alas, alas!" he cried, "my beautiful lady is gone! All is lost, lost!"

"Not so," cried the man with the wonderful ears. "I hear her weeping, but the sound comes from afar."

"I see her seated on an enchanted rock three hundred miles away," cried the sharp-eyed man.

"Describe the place," said the tall man, "and I will bring her here in three minutes."

When the old Queen came back at twelve o'clock, she was amazed to find her daughter sitting just where she had left her.

"Take her; you have won your bride," she said to the Prince.

But as she passed she whispered to the Princess: "I would scorn to be won by a pack of servants."

The idea was so displeasing to the pride of the Princess that she turned to the Prince and said: "Before you can win *my* consent, one of your wonderful servants must consent to be flung on a pile of three hundred burning logs, and there remain till the fire has burned out."

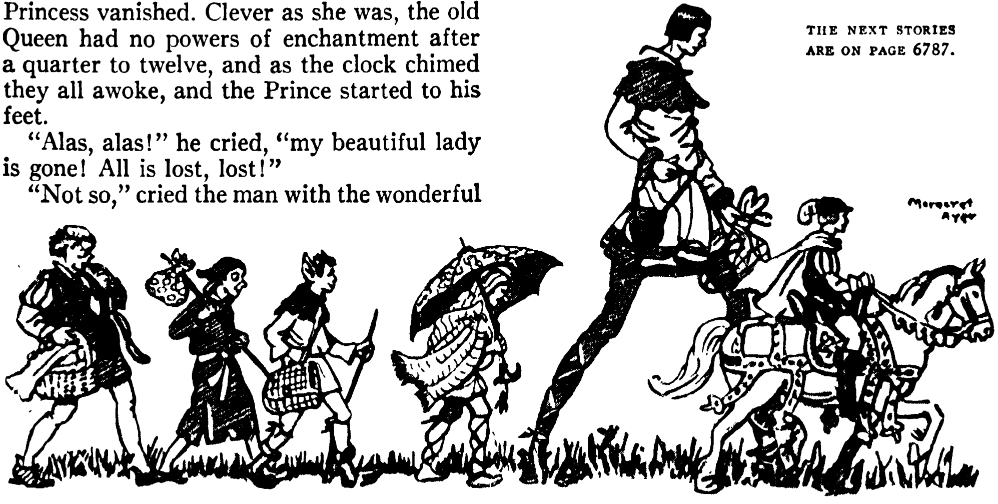
"Good!" answered the frosty man, stepping forward without any hesitation.

So the logs were brought, and the fire started; and for three whole days the court watched the man as he lay shivering and shaking with cold on the burning pile. When the last flame had flickered out, the frosty man rose to his feet and said that he had never felt so cold in his life.

The Princess was delighted that her handsome lover had once more triumphed.

Now the bridal day was fixed, and the wedding took place and the happy pair and their five servants set out for the palace of the Prince.

THE NEXT STORIES ARE ON PAGE 6787.



Heels a-flying, a colonial pair jig to the rollicking tune of YANKEE DOODLE.

Illustration, courtesy, Jacob Landau, from "Stories of Our American Patriotic Songs"

SONG-WRITERS OF THE UNITED STATES

THE good ship Mayflower, bound for America, carried a Psalter, prepared in 1612 by Henry Ainsworth. Even men as solemn about spiritual matters as the Pilgrim Fathers realized that the Psalms were more beautiful and more inspiring when they were sung than when they were spoken. Most of the early Psalm books imported from England contained words only. The tunes were familiar to many members of the congregation, but an Elder helped along the less secure by singing off a line at a time, which the others repeated after him. It is easy to understand what happened to the melodies as the years went by. Even the Elders who were musical enough to remember the tunes correctly changed them, and the same Psalm in two different communities came to be sung quite differently.

The first book printed on American soil was an almanac; the second was the BAY PSALM BOOK, which came out in Cambridge, Massachusetts, in 1640. In this the Puritans of Boston tried to make the words of the Psalms, cast in meter to be sung, nearer to the words as they were in the Scriptures. The difficulty with the melodies was still so great fifty years later that the new edition of the PSALM BOOK had twelve tunes in it. This brought up more troubles because many church members thought it wicked to learn to read notes. The New Englanders disliked change so much that when the first organ was shipped to Boston from England in 1713 it was not unpacked for seven months. The congregation considered organ music too frivolous for Divine Service.

The early Puritans were not allowed to invent tunes, but by the middle of the eighteenth century some of the intolerance had vanished. William Billings, born in 1746, was a tanner by trade, but a musician by nature. It is said that he wrote his first song with chalk on a piece of leather. His lack of education made his early composing difficult, but he struggled on until he had developed his own form of counterpoint. Instead of writing hymns that were lines of vertical chords he gave the individual voices more activity. The soprano might start her part before the alto or after the tenor and pursue her melodic way, independent of the other voices but in complete harmony with them. Johann Sebastian Bach had been doing that for some time in Germany, but the idea was a new one in the colonies.

By 1770 Billings had enough material for his first book, THE NEW ENGLAND PSALM SINGER AND AMERICAN CHORISTER. For ten more years he worked, improving his way of writing, then he published his second collection, BILLINGS' BEST, which he considered far superior to the first. Two of the most interesting of Billings' songs are a stirring religious war song, CHESTER, and a Christmas carol, A VIRGIN UNSPOTTED. Billings made one other important contribution to American musical life. He founded the Stoughton Musical Society in 1774. By that time serious singing societies were accepted, even in New England. In this way the average citizen came to know the music of his own country and that of other countries.

FRANCIS HOPKINSON, LAWYER, POET AND "FIRST AMERICAN COMPOSER"

A Philadelphia man who is called the First American Composer had a background and education quite different from that of the little tanner. He was Francis Hopkinson (1737-91), a college man, lawyer and poet. He played the harpsichord and the organ. He was one of the signers of the Declaration of Independence. Among his friends were Washington and Franklin. As one might easily suspect, Hopkinson's interest was not in sacred music. His first song published was MY DAYS HAVE BEEN SO WONDROUS FREE, which, like many of his other compositions, was in gay, early English style.

From the end of the eighteenth century to the time of the Civil War, few important composers came forward. Hymns were written, of course, especially in New England. People loved to sing them, not only in church, but also around the house organ or melodeon at home. Besides the hymns there were ballads, tales of the lover who went to war or to sea, and of the faithful maiden who pined away when he did not return. Most of the ballads were English folk songs with the stories changed to suit conditions in the colonies. The words of the favorite ballads were printed on large sheets called broadsides, and were sold by peddlers for a penny apiece.

Another type of musical offering was the election song. The politicians wrote new words to old tunes and soon had the voters singing of the superiority of one candidate and the many faults of his opponent. One of the earliest ones was WASHINGTON AND JEFFERSON which appeared in 1801.

The idea of using election songs still persists. Alfred E. Smith, when he was running for the presidency in 1924, used as his campaign song THE SIDEWALKS OF NEW YORK, which had been written in 1894 by Charles B. Lawlor and James W. Blake of the vaudeville stage. Alfred M. Landon in 1936 used the Stephen Foster song O, SUSANNA to rally his followers.

After 1750 a number of singing societies were started in different parts of the country. The most famous is the Handel and Haydn Society of Boston. The members pronounced Haydn "Hay-den" (instead of "Hi-dn") but that mistake in no way affects their importance in the musical progress of the young United States. The society began early in 1817, when sixteen gentlemen met to discuss "the expediency of forming a society for cultivating and improving a correct taste in the performance of sacred music." They first studied American hymns and church music, but soon added parts of the sacred music of Handel and Haydn. Three years after this simple beginning they performed the entire oratorio MESSIAH, for a Boston audience.

YANKEE DOODLE, WRITTEN IN SCORN, BECOMES A PROUD AMERICAN SONG

Our patriotic songs have come from time to time to fill the national need of expressing strong emotion in a crisis, which usually has meant before or during a war. The first of these that we still sing goes back before the Revolution to the French and Indian Wars. We are told that Doctor Shuckburgh, an English surgeon with the elegantly outfitted Redcoats, wrote it to make fun of the shabby colonial volunteers. The song is, of course, YANKEE DOODLE. The melody was probably an English folk dance. Doctor Shuckburgh's words were changed and the song enlarged upon some years later when the patriots sang YANKEE DOODLE as a taunt to their better-dressed enemies in the Revolutionary War.

Nearly everyone knows the story of Francis Scott Key (1780-1843) of Baltimore and the writing of THE STAR-SPANGLED BANNER, during the War of 1812. In September, 1814, Key had gone under a flag of truce to the British gunboat Surprise, to request the return of a doctor who had been captured. The British fleet was shelling Fort McHenry from the harbor, and Key was forced to stay aboard until morning. He had no way of knowing how the battle was progressing. Finally the early dawn showed him the Stars and Stripes still flying, and he wrote his poem of thanksgiving. The music is that of an old English drinking song, TO ANACREON IN HEAVEN, composed by John Stafford Smith.

The words to AMERICA (My Country 'Tis of Thee) were an expression of joy in the security the young nation was beginning to feel as it reached its half-century mark. They were written by Samuel Francis Smith (1808-95), a Baptist clergyman, college professor and poet. At the request of the great hymn-writer and educator Lowell Mason, Doctor Smith chose the melody from a new collection that had come from England. He did not know that he had picked the tune which Henry Carey had arranged one hundred years earlier as GOD SAVE GREAT GEORGE, OUR KING, now the British national anthem. Doctor Smith found the melody inspiring, and the children of the Park Street Church in Boston were inspired by the words as well, when they performed the song for the first time, July 4, 1832. The listeners were so stirred that they rose to their feet at the end of the hymn.

THE LIVELY MARCHING SONGS OF THE CIVIL WAR

The Civil War brought a new surge of patriotic feeling and with it more songs. Best loved were the marching songs. It is easier to tramp long distances if you are keeping step to vigorous music. Julia Ward Howe wrote THE BATTLE HYMN OF THE REPUBLIC to the tune of JOHN BROWN'S BODY when she heard the men singing that on the way home from a skirmish near Washington. William Steffe is credited with the music but it is more likely that he arranged an old Negro camp-meeting melody.

James Ryder Randall from Baltimore was a newspaper man in New Orleans in the early days of the Civil War. Since his sympathies were entirely with the South he was impatient because his native state had not taken a definite stand on the side that he thought right. One night a message came that the people of Baltimore had fired on Massachusetts troops passing through the city. He was so overjoyed to know that his state was joining the Confederacy that he sat down at once and dashed off MARYLAND, MY MARYLAND. The words appeared in his paper the next day. A Miss Carey of Baltimore adapted it to the German folk tune O TANNENBAUM. It was popular immediately and in a short time had spread to all parts of the South.

General Butler's Union Army had as a bandmaster an Irishman, Patrick S. Gilmore. He wrote WHEN JOHNNY COMES MARCHING HOME AGAIN to a melody which he heard a Negro singing. The song has a bright Celtic lilt. It was long a favorite of fighting men—even as late as World War I.

GEORGE F. ROOT, POPULAR SONG-WRITER OF THE LATE 1800's

George F. Root (1820-95), who wrote the words and music of TRAMP, TRAMP, TRAMP, THE BOYS ARE MARCHING, THE BATTLE CRY OF FREEDOM and JUST BEFORE THE BATTLE, MOTHER, was a trained musician. He started life on a farm near Sheffield, Massachusetts. Because of his keen interest in music his family sent him to Boston to study. He was a teacher and organist in New York for some years, but at the time President Lincoln needed songs to urge men to enlist in the Union Army, Root was publishing music in Chicago. He composed many of the sentimental ballads which were popular until ragtime and jazz "took over" the American home early in the 1900's. THERE'S MUSIC IN THE AIR is one of the loveliest and best-known of Root's songs.

Katharine Lee Bates (1859-1929) was a Massachusetts girl. She became first a student, then professor of English in Wellesley College. In 1893 she made a trip west during her summer vacation. She was so thrilled by the beauty of her own country, especially when she saw the grandeur of the Rocky Mountains, that she wrote the poem AMERICA, THE BEAUTIFUL. Then she put it away for two years. When it finally appeared in print, people insisted that it be set to music. Since none of the tunes that were written especially for it were suitable, Miss Bates studied hymns until she found that the music of O MOTHER DEAR, JERUSALEM (written by Samuel A. Ward in 1882) was what the poem needed. That is the way we sing it today.

Many of the Spanish-American War songs were rough and distinctly uncomplimentary to the Cubans, the Filipinos, the United States officers and the weather. Most of the men were not too anxious to go into hot climates to fight the Spaniards. In 1896, however, Joe Hayden and Theodore Mertz wrote a song which became popular beyond their most optimistic hopes . . . There'll Be a Hot Time in the Old Town Tonight. The soldiers sang it and the bands played it so much that the Spaniards assumed that it was the American national anthem. One Spanish officer is reported to have said that if the fighting had been as bad as the singing the United States would have lost the war.

The Caisson Song was written in 1908 by Major Edmund L. Gruber when he was serving in the Philippines as a lieutenant in the Fifth Field Artillery. His battalion, the Second, asked for a song to celebrate the coming of the First Battalion of the Regiment, to relieve the Second. The shouted words "Keep them rolling" were a reminder of a difficult march across the mountains the year before, when the leaders had urged their men over a bad section of road.

No one knows who wrote the first lines of the Marines' Hymn—"From the halls of Montezuma to the shores of Tripoli." They have been inscribed on the Marine Corps colors for years. They refer to the Mexican War and the campaign against the Barbary pirates. In 1911, Colonel H. C. Davis, United States Marine Corps, added the second and third verses, and in 1942 an official order changed the fourth line of the first verse to "in the air, on land and sea" to include the air arm of the Corps. The music is a duet of two men-at-arms from the Offenbach opera Genevieve de Brabant.

Anchors Aweigh was a football song of the Naval Academy, used first in 1906. Commander A. H. Mills wrote the words and Charles A. Zimmerman, musical director of the Academy, the music. In 1942 Commander Mills revised it to include lines about the Germans and Japanese.

Joseph Boggs Beale, Modern Enterprises, Phila., Pa.

In OLD FOLKS AT HOME, Foster was expressing the homesick longing some Negroes felt after the Civil War for their old secure plantation homes "Way down, upon the Swanee Ribber."

The United States Coast Guard was established in 1790, as a part of the Treasury Department. Its job was to protect the home shores, but at first many of its efforts went to curb smuggling. Its motto is *Semper Paratus* (always ready). In 1928 its official march appeared in the Coast Guard Magazine. It is Semper Paratus by Captain Francis Saltus Van Boskerck, United States Coast Guard.

World War I gave us Over There, the liveliest of marches. George M. Cohan (1878-1942), who wrote the words and music, was very much a part of the Broadway theatrical scene. He was an actor, producer, playwright and composer. He wrote Over There to give the United States a song as stimulating as the popular British Tipperary. Congress awarded Cohan a medal for his patriotic service.

The bugler is perhaps one of the most unpopular men in the army. In World War I Irving Berlin used the notes of reveille as the skeleton of his famous Oh! How I Hate to Get Up in the Morning. At the top of the printed song is the dedication: "To my friend Private Howard Friend, who occupies the cot next to mine and feels as I do about the bugler."

In 1938 the Army Air Corps, the youngest branch of the armed services, had very little tradition and no song. Bernarr Macfadden, through Liberty magazine, hoped to remedy this. He offered a prize of $1,000 for a song that would be acceptable. It was not until October, 1939, that the prize was awarded. The words and music of The Army Air Corps are by the Alaska-born Robert Crawford, a radio singer and composer.

From the middle of the nineteenth century until well into the twentieth, minstrel shows flourished in the United States. The performers were usually white men who blacked their faces with burnt cork. They often aroused the final laugh in the act by removing their gloves and dancing off the stage with black faces and white hands. Daniel Decatur Emmett (1815-1904) was a member of a famous group called the Virginia Minstrels, which he organized in 1843. Emmett wrote many of his own songs. We know best his OLD DAN TUCKER and DIXIE. Although he was born in Mt. Vernon, Ohio, he had caught the spirit of the South so well that the Confederates sang DIXIE during the Civil War, using words by General Albert Pike.

STEPHEN COLLINS FOSTER, WHOSE FOLK SONGS WILL NEVER DIE

Another composer who did some of his writing for minstrel shows was Stephen Collins Foster (1826-64). He was born in Pittsburgh, Pennsylvania, on the fiftieth anniversary of the signing of the Declaration of Independence. His melodies are simple and well within the range of anyone who can carry a tune. The chords to accompany them are easy to find on a piano or stringed instrument. The words are about things close to the heart of everyone—home and the desire to be there if you are far away, as he often was. MY OLD KENTUCKY HOME and OLD FOLKS AT HOME are among his most popular songs. For Christy's Minstrels he wrote MASSA'S IN DE COLD, COLD GROUND. He was a professional song-writer from 1849 to 1860, earning an average of $1,300 a year, which was a good living in that day. However, the life in the entertainment world was bad for him, since he had a fatal weakness, the craving for drink. When he was only thirty-seven years old, he died after an accident. We owe much to this unhappy man, for his two hundred songs are truly American folk music.

THE OLD OAKEN BUCKET is the only enduring work of a man who wrote verses from the time he was fourteen until he died. The poem is not great, but it expresses the feelings of so many people that it lives on.

Samuel Woodworth (1785-1842) wandered from his home in Scituate, Massachusetts, to many parts of the country, looking for work he did not want and did not keep, because it took time from his writing. For some years he lived in New York. He came in from the street one hot summer day in 1817 and asked for a glass of water. He remarked, as he drank it, that it was good but that it would have been much more refreshing from his father's old oaken bucket at home. His wife, who must have been accustomed to his ways, said that was a good idea for a poem.

The music was written by the English composer, George Frederick Kiallmark, for ARABY'S DAUGHTER, a poem by Thomas Moore. Frederick Smith arranged it for THE OLD OAKEN BUCKET.

The psalm-writers of the early days were replaced by hymn-writers as the churches became more and more tolerant of original music. One of the greatest of the hymn-writers was the founder of a family which has probably contributed more than any other to American music. Lowell Mason, who lived from 1792-1872, wrote at least eight hymns that still appear in the modern hymnal. The best known are NEARER, MY GOD, TO THEE, and FROM GREENLAND'S ICY MOUNTAINS. Mason taught music and organized singing groups, compiled song books for public schools, collected and corrected other hymn tunes, inspired the writing of AMERICA, and conducted the Handel and Haydn Society for a time. Two of his sons, Daniel Gregory and Lowell, Jr., had a publishing house which was busy printing the books of their industrious father. Another son, Henry, was a founder of the Mason and Hamlin Company which built organs at first, then from 1882 on, fine pianos. A fourth son, William, was a concert pianist and teacher in New York. Henry's son, Daniel Gregory Mason, born in 1873, is a composer, lecturer and writer of renown.

THE ROMANTIC PERIOD IN MUSIC INSPIRES EDWARD MacDOWELL

The United States can be proud of one composer who ranks with the Europeans of the great Romantic period. This was the era of program music, which tries to describe in musical sounds an idea which can be put into words. He was Edward MacDowell, who lived from 1861 to 1908. He wrote thirty-nine songs, using his own poems for some of them.

After his death his wife Marian turned his 600-acre estate in Peterborough, New Hampshire, into the MacDowell Colony. Twenty-four cabins have been built in the beautiful woods, and there musicians, writers and artists may go to work undisturbed for the summer months. Willa Cather, Stephen Vincent Benét, and Hans Barth are among those who have done valuable work there.

Charles Wakefield Cadman (1881-1947) went back to the first inhabitants of this country, the American Indians, for his inspiration. Nellie Eberhart, who wrote the words for his famous song, AT DAWNING, stimulated his interest in Indian music. He spent a summer with the Omaha tribe, studying their ceremonial songs. He wrote an Indian opera, SHANEWIS, which was produced by the Metropolitan Opera Company in 1918. Nearly everyone knows his Indian ballad, FROM THE LAND OF THE SKY BLUE WATER.

Oscar Rasbach, born in Dayton, Kentucky, in 1888, has helped assure the immortality of an American poet with his appealing song, TREES. Joyce Kilmer (1886-1918) wrote the poem. (See Kilmer, in the Index.)

Oley Speaks (1876-1948) wrote many fine songs; three of them have become especially popular. SYLVIA, with words by Clinton Scollard, is a melodic love song. ON THE ROAD TO MANDALAY is a setting of one of Kipling's BARRACK ROOM BALLADS. Another charming love song is his MORNING, set to verses by Frank L. Stanton.

It is difficult and often impossible to trace the origin of many of our most beautiful songs. Some of them came over with the early settlers, for example, the songs of the Kentucky mountains. These are ballads, using the same stories and tunes as the English ones of two and three hundred years ago. One of the early collections was made by Howard Brockway and Loraine Wyman who went into the mountains when traveling was extremely difficult, lived with the people, listened to their songs and wrote many. The book by Brockway and Wyman, LONESOME TUNES, has many old favorites: BILLIE BOY, BARBARA ALLEN, SOURWOOD MOUNTAIN, and FROG WENT A-COURTIN'.

Professor J. A. Lomax, and N. Howard Thorp, the cowboy poet, have performed the same service for us in collecting songs of cowboys of the West. The great, lonely treeless plains gave men rugged, realistic things to sing about. THE LITTLE OLD SOD SHANTY brings to light the housing problem in Nebraska where a whole town that boasted one tree considered itself lucky. The cowboys sang of the things important to them, OLD PAINT, the favorite horse; GIT ALONG LITTLE DOGIES, the undersized calves; or THE OLD CHISHOLM TRAIL, which led to the nearest town. TURKEY IN THE STRAW and THE OLD GRAY MARE were popular songs carried west by the pioneers. The loneliness is evident in THE COWBOY'S DREAM, THE COWBOY'S LAMENT and THE DYING COWBOY. HOME ON THE RANGE comes from Kansas. Doctor Brewster Higley wrote the words in 1873, and his friend, Dan Kelly, a guitar player, the tune.

Songs have sprung up among various groups of workers. The sea chanteys express the rough independence of the sailor. WHISKEY JOHNNY, BLOW THE MAN DOWN and CAPE COD GIRLS are full of the rhythm of a square rigger under sail.

Negro work songs are numerous. A famous one with many versions is JOHN HENRY. John Henry tried to prove to his Cap'n that he could break rocks as fast as the new steam drill and he "died with his hammer in his hand." I BEEN WORKIN' ON DE LEVEE is a song of the Mississippi, but it is better known with the word "Levee" changed to "Railroad."

R. Emmet Kennedy has published a collection of work songs and chanteys called MELLOWS, which he says is a Negro word for melody. In it is the beautiful song of the New Orleans chimney sweep, ROMANAY. There is a RAILROAD TRACK MENDERS SONG, too. At the end of each phrase is a grunted "umph" to help the men pry loose a troublesome rock or railroad tie.

The building of the Erie Canal early in the nineteenth century opened up new sections of the country. A wonderful song of

Joseph Boggs Beale, Modern Enterprises, Phila., Pa.

What a welcome he receives WHEN JOHNNY COMES MARCHING HOME AGAIN! This Civil War song, with its swinging tune and heartfelt words, remained popular for many years.

this era is about a mule named Sal who hauled barges fifteen miles a day along the new waterway. It is called THE ERIE CANAL. Most of these songs can be found in Carl Sandburg's THE AMERICAN SONGBAG.

A great railroad song is CASEY JONES, the true story of John Luther Jones, an engineer. There are many versions of it. It may have been written by Jones's Negro helper, Wash Saunders, after Casey was killed when his engine traveling seventy miles an hour jumped the track on a curve in Mississippi.

COLLEGE SONGS TELL A STUDENT'S LOVE FOR HIS ALMA MATER

In 1836 Harvard celebrated its two hundredth birthday. The Reverend Samuel Gilman of the class of 1811 had come from Charleston, South Carolina, for the occasion. In his younger days he had taught at Harvard, and had written the Harvard Phi Beta Kappa poem. He was given the task of writing a Harvard alma mater song. His poem, FAIR HARVARD, was set to the tune of MY LODGING IT IS ON THE COLD GROUND, from the play THE RIVALS; the music was either written or arranged by Anna Lee in 1778. Thomas Moore's poem BELIEVE ME IF ALL THOSE ENDEARING YOUNG CHARMS was set to the same tune. Harvard gave the Reverend Gilman an honorary degree the commencement after he had provided his much loved masterpiece.

LORD GEOFFREY AMHERST, by J. S. Hamilton of the Amherst College class of 1906, is such a popular tune that boys and girls in schools and summer camps all over the country have given it new words and used it many times. This is true, too, of THE SON OF A GAMBOLIER, which we associate with Rutgers University and Georgia School of Technology (I'M A RAMBLING WRECK FROM GEORGIA TECH). It is hard to trace the origin of this song. Probably it started with Irish laborers who came to the United States early in the nineteenth century.

Marching songs are an essential part of every football game. The famous Yale march DOWN THE FIELD was written by C. W. O'Connor and Stanleigh P. Friedman. THE VICTORS, University of Michigan song, was the work of Louis Elbel of the class of 1900.

The tune ANNIE LISLE seems to suit the alma mater spirit better than any other. It has been used by many colleges and schools. Probably the Cornell words by C. K. Urquhart are the most famous. Syracuse and Columbia universities also use the tune for their alma mater songs. The University of Pittsburgh uses a famous Haydn melody for its alma mater. It is the theme of the EMPEROR quartet, the melody of which was the old Austrian national anthem.

Dutch traders landed their first cargo of African Negroes in Jamestown in 1619—twenty men and women who were sold as slaves. Because the business was profitable, every year thereafter saw more unfortunates brought across the ocean to be sold to the colonists. They came from many parts of Africa, from tribes with different languages and religions. They found themselves in a strange country with strange, white-skinned people, who spoke the English language. From their owners they learned to know the Christian religion, and there they found their greatest hope and solace. Bondage, even under kind masters, is an unnatural condition. It is easy to understand why the Negroes found in Christianity the hope of a brighter future—freedom such as the Children of Israel had found after their bondage in Egypt.

THE BEAUTIFUL FOLK MUSIC OF THE NEGROES —SAD, HAUNTING AND YET HOPEFUL

These sad people created the most beautiful folk music of all time—their spirituals. Most folk songs are simple melodies with simple rhythms. They describe the everyday things of life or they tell a story. The spirituals add harmony to melody and rhythm, which shows that they must have been developed by a group. They tell a Bible story in the language of the Bible or express respect or fear for some phase of the Christian religion. Two great colored men, brothers, collected and arranged many of the spirituals—James Weldon Johnson (1871-1938) and J. Rosamond Johnson (1873-). James Weldon Johnson was a composer, author, lawyer, poet, diplomat and educator of his own people. J. Rosamond Johnson is a graduate of the New England Conservatory. He is an actor, writer and composer of popular and serious music. One of his early popular songs was UNDER THE BAMBOO TREE. The two brothers wrote the song that has been called the Negro anthem —LIFT EVERY VOICE AND SING.

Another gifted composer who has used the spirituals as a background for serious works is Henry T. Burleigh (1866-). He studied in the National Conservatory of Music in New York. Antonin Dvořák was in America at the time and was director of the school. Burleigh studied composition with Dvořák after doing some work with Rubin Goldmark. The Czech composer and the American Negro became fast friends, and it was in that way that Dvořák became acquainted with the spirituals and used them later in his symphony FROM THE NEW WORLD and his Violin Sonatina.

Many people sing CARRY ME BACK TO OLD VIRGINNY and IN THE EVENING BY THE MOONLIGHT without knowing that they were written by a Negro, James Bland. The songs adapt themselves easily to the style of singing called "barber shop." The barbers of the South were usually colored men. In idle moments they sang together, trying out new and unusual combinations of sounds. The successions of minor and diminished chords which they originated have come to be known as "barber shop" harmonies.

Negro musicians are at their best in the world of dance music. They have never lost the wonderful rhythm of the drums and tom-toms of their African ancestors. The foremost composer in this field is William Christopher Handy (1873-   ), "the father of the blues." His father and grandfather were Methodist ministers and important citizens in Florence, Alabama. His family was horrified when he saved his money for months to buy a guitar. They called it an "instrument of the Devil" and made him exchange it for a dictionary. The boy tried to please his family by going on with his education, but the musical urge was too great. Someone sold him an old cornet for $1.75 and he entered upon a career that was sometimes successful and sometimes not. In his MEMPHIS BLUES and ST. LOUIS BLUES he combined many elements and started a new style of music writing. He used as his basis the "blues" song, which is the lament of a Negro bemoaning his personal sorrow. Handy added the syncopation of ragtime and the rhythm of the tango. Blues of all sorts, with their use of three instead of four phrases in a group, influenced dance music for years.

Around 1900 the American public began to tire of the oversweet sentimentality of the ballads. Negro bands were leaving New Orleans and moving north to Chicago. They brought with them their skill on the piano, trumpet or drums, and their wonderful rhythms, always changing, always new. Soon there was a new kind of music—purely American. It was called "jazz," no one seems to know why.

Four men stand out from the many popular song-writers of the twentieth century. Irving Berlin has been writing successful songs since 1909. George Gershwin wrote great music for piano and orchestra as well as for the theater.

Jerome Kern and Richard Rodgers have proved that the average theater audience enjoys shows that break away from the set plan of old style musical comedies . . . chorus girls, a shallow plot, and songs that follow the thirty-two measure pattern of tap-dance routines. Kern and Rodgers have developed a new, intelligent structure that is fast becoming America's form of opera.

Irving Berlin was born in Siberia in 1888. When he was four his family fled to New York, where his father was cantor (singer) in a synagogue, as many members of the family had been before him. The boy left school when he was eight years old, because the death of his father made it necessary

Courtesy, Kern and Hammerstein's production of SHOW BOAT.

Scene from Jerome Kern's melodious SHOW BOAT. The loved songs from this musical play seem destined to "just keep rolling along."

for him to sell papers and do odd jobs to help support the family. When he was sixteen he worked as a singing waiter in a cafe in New York's Chinatown. That was when he started to write songs. ALEXANDER'S RAGTIME BAND, which came out in 1911, is one of the most popular songs of all time.

In both world wars Berlin wrote and produced soldier shows and gave the profits to war charities. He has written the words and music of nearly a thousand songs, suiting every mood, from the self-pity of ALL ALONE to the gay and provoking EASTER PARADE. Every year he finds fresh ideas with which to please the public, even though he is not a trained musician, plays only in one key, and has to have a musical secretary to take down his songs.

Jerome Kern, born in New York in 1885, studied at the New York College of Music, and in Europe. He began to write successful musical comedies and operettas in 1911. He was the first thoroughly trained musician to enter the popular-music field. He had, besides this gift for creating charming melodies, the theoretical knowledge that helped him to use that gift to the greatest advantage. Perhaps that explains why he held for so many years his position as one of the finest composers of theater music.

Kern's songs (most of which were written for Hollywood or for Broadway plays) were developed with the greatest care. When he decided to make a musical play of Edna Ferber's SHOW BOAT his friends thought he had attempted the impossible. He worked on it for nearly a year and wove into it songs that are as popular today as they were in 1927, when they were new—OL' MAN RIVER, and CAN'T HELP LOVIN' DAT MAN are among them. In 1936, THE WAY YOU LOOK TONIGHT, from the motion picture SWING TIME, was given the Motion Picture Academy Award as the best screen song of the year. Kern died in 1945.

GEORGE GERSHWIN SPANS THE GAP BETWEEN POPULAR AND SERIOUS MUSIC

Even when he was very young, George Gershwin (1898-1937) felt that popular music could be great music. It was his ambition to interpret his native land to itself in music everyone could understand and enjoy. He felt that the basis of music in the United States must be Negro music with its beautiful but simple melodies and its unusual harmonies and rhythms.

Gershwin was a serious student, even though he always insisted that his field was jazz. He had to be serious to study with Rubin Goldmark and Joseph Schillinger, great teachers both. Unlike most of the writers of Broadway and Hollywood, he did his own orchestrating. The exception is RHAPSODY IN BLUE; when he composed that in 1923, he had not had enough experience to handle such complicated scoring alone.

With his brother Ira, George Gershwin wrote delightful songs for the theater and movies, THE MAN I LOVE, EMBRACEABLE YOU and I GOT RHYTHM, for example. His greatest work was the Negro folk opera PORGY AND BESS. To be sure that his melodies were true expressions of the Negro spirit, and that he had the real feeling for the characters in the play, he spent several weeks in Charleston, South Carolina, where the story is laid.

MUSIC TO FIT THE ACTION OF A PLAY, AS WRITTEN BY RICHARD RODGERS

Richard Rodgers was born in New York in 1902. His musical ability was evident before he could talk; and he could find tunes on the piano and make up little melodies when he was four. His mother gave him his first lessons. The piano was his instrument, but his interest was in composition. He wrote his first song when he was fourteen. He spent a short time at Columbia University and then had three years of hard work at the Institute of Musical Art in New York.

Rodgers is a composer who thinks only in terms of the theater. When he writes the music for a play, each song or section must be a musical expression of the drama at the point where it is to be sung or played. Before he writes a song, he considers the ones that precede and follow, the character who will sing it, the words, the mood, the action. The words go over and over in his head and suddenly he has the melody ready to write.

Some of his favorite songs are BLUE ROOM from THE GIRL FRIEND and MY HEART STOOD STILL from CONNECTICUT YANKEE. In OKLAHOMA, he began to adjust his style more toward that of opera, a form of music which seems remote from Broadway. In CAROUSEL he went even further in that direction. There is the spoken word with music going on in the background, and there are parts in which the story is actually told in song. It will be interesting to find, in the years to come, whether or not PORGY AND BESS and CAROUSEL are as they seem today, major steps forward in American music.

By URANA CLARKE.

THE NEXT STORY OF MEN AND WOMEN IS ON PAGE 6603.

SOAP SCULPTURE

All pictures, courtesy, Procter and Gamble

DOWN through the ages, since men first learned to use crude tools, there have been artists who carved things of beauty in the materials which they had at hand. The cave-dweller carved bone and ivory, as the Eskimo still does; the Indian used wood and soft stone. The more civilized white races gradually developed the use of marble. Other materials, too, came into fashion—such as granite and various metals.

One of the most interesting materials of all for carving purposes is soap—yes, the soap that you use for your face and hands or for the bath. With only a few bars of soap and some simple household tools you can carve away to your heart's content. The photographs in this article show what fine results you may obtain.

Not many years ago the idea of sculpture in soap would have been considered an ingenious trick, like the sculptor Canova's feat of carving a lion in butter. Nowadays, however, professional sculptors sometimes use soap as a material in preparing models for big marble statues. Children and grownups, too, are discovering the fun of carving soap as a hobby. It is an excellent form of amusement for a party; it gives every guest a chance to exercise his skill and imagination, without previous experience.

All you will need for soap-carving will be a paring knife or a penknife and one or two orangewood sticks. The knife you use should have a thin pointed blade of medium size. Orangewood sticks such as are used in the care of the fingernails are suitable, because they have points and edges in a variety of shapes. It is a good thing also to have a small tray under your soap in order to catch the shavings, or else to spread newspapers on the table around which you and your friends work. The left-over bits of soap need not be wasted; they can be used for washing purposes.

The first step in carving is to prepare a cake of white soap. This is done by cutting off the outer surfaces on all sides with the knife, removing the lettering and the raised edges. As little as possible should be taken off on the narrow sides. It is necessary to remove all the outer surface, which is a little drier than the rest of the soap. This step helps to prevent warping after the model is finished.

The second step is to apply the design. This is done by first sketching on paper the subject chosen. The paper should be the same size as the cake of soap. The design should be so arranged that it will be in the center of the cake when the paper is placed over it. To transfer the design to the soap, first place a piece of carbon paper, the same size as the cake, on the soap. Then put the paper containing the design upon the carbon paper. Then trace over it lightly so that the carbon will not smear. If it does smear, a thin layer may be scraped off the top of the soap, and you will be ready to repeat the tracing.

The third step is to cut the outline. This is done by removing the greater part of the soap which is not used in the model. The cutting is started at the upper right-hand corner; you should leave a quarter of an inch outside of the traced design. The cake of soap should be cut clear through from top to bottom, so that the excess soap may be removed all the way round.

The charming statuettes in this picture show the variety of treatment that is possible in soap sculpture.

Now the real carving of the model begins. First, all of the more important parts of the figure are outlined. Each high point is taken in turn and outlined roughly. The high points, of course, are those nearest the surface of the soap. The low points are those farther in. After completing the rough construction, carving is continued from the highest points to the next highest and so on, until all the excess material has been cut away from the highest and lowest points. When the model has been well shaped, it is time to start finishing the details. Before you do so, however, go over the model carefully in order to be sure that the general form is correct.

In working on the details of the model, you should cut away all sharp edges and smooth the rough surfaces. The model should be turned often so that the various parts are completed gradually. Do not try to complete one single part, such as the head, before beginning one of the other parts. The model must be carved as a whole. Otherwise the various parts of the finished figure are apt to be badly out of proportion.

The finishing touch is polishing, which is done after the model has been completed and has been allowed to dry for a day or two. In polishing a soap sculpture, first rub it all over carefully with a paper napkin, being particularly careful of projections which might break off. Then rub it gently with the fingertips and the palm of the hand. The finish thus produced is soft; yet it brings out the highlights.

If you plan to carve a sculpture larger than can be produced from a single cake of soap, you may join several cakes before carving is begun. To do this, shave off the surface from all sides of the cakes so that the slightly drier surface is removed. Place the cakes side by side in a pan with just enough water in it to cover the edges of the soap that are to be joined.

Heat slowly until the part of the soap in the water becomes jelly-like. Insert the sharpened lengths of toothpicks so that they will reinforce the joints. Be careful to put these in a position which will not interfere with the carving later. Press the cakes together and put a weight on them for several hours until the joint has hardened thoroughly. Smooth off the soap which has squeezed out at the edges of the joint. It is better to let each joint harden before adding another cake to the piece. You can put together a considerable number of cakes of soap in this way.

In choosing the subject to be carved, you may copy an object in the room or something that you have seen, such as an animal or a building. Remember that a picture seldom contains the elements of a good sculpture. It is well to copy first a piece of sculpture. Then after you have become quite skillful, you may go on with original designs having length, breadth and thickness.

It is most important to work out the main outlines of your object first. Details may be worked in later. The successful sculptor looks for the big forms, that is, the main outlines. He studies his object with half-closed eyes and observes the simple masses of the composition and then reduces them to even simpler forms in his soap carving. Small details are unimportant and often serve only to confuse the worker.

Graceful busts, full-length figures, animal groups—all these are likely subjects for the soap sculptor.

Look at the pictures that illustrate this article and you will see an amazing lack of detail. Yet the sculptures are true images of the models they represent.

Round forms are sometimes broken up into planes by the sculptor. Get these flat surfaces first. Then round your edges, if you like; or if you prefer, you may leave these edges in blocked form.

A bird's wings or a fish's fins may be kept very thick and the illusion of lightness may be produced by keeping the form thinner at the edges. Thin, projecting forms are to be avoided in all sculpture, and if you attempt them in soap they are almost certain to break off. An amateur with considerable skill was carving a Dutch windmill. In his desire to bring about an airy effect, he made the planes too thin and two of them broke off, just as his model was finished. He could have produced the same effect of lightness by keeping the wings sturdy near the body of the windmill and then thinning out the wings at the edges.

Watch your outlines. Keep them simple. Turn the work often. Do not carve too long in one place. Hold the model in different lights and at different angles, and when everything seems right the work is probably finished. If you work at the model too long from one view, you may find that it is entirely wrong from another angle.

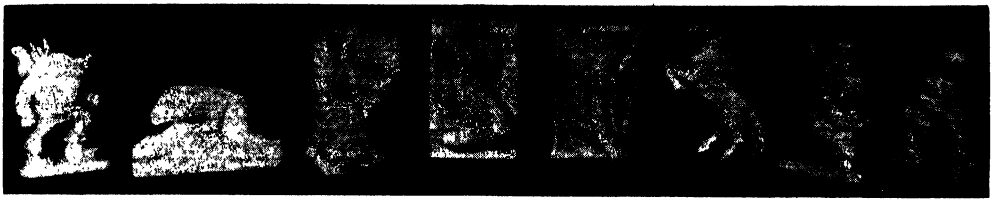
Do not take yourself or your task too seriously. A bit of humor need not rob your work of any beauty or dignity of line. Be unafraid while you are working. Relax and enjoy it. When the carving is done, study your model and decide for yourself what mistakes you made in carving it.

The following subjects have provided inspiration for many interesting and beautiful soap sculptures: animals, famous people, birds, the human body, handsome buildings, furniture, jewelry, plants, fish, and pottery. Groups of various sorts—an orchestra, a basketball team, children at play—make interesting subjects. Soap is suitable, too, for big displays. For example, one class in a large school worked together to produce an entire village of white soap.

Soap is useful in making heads of puppets for a puppet show, for block-printing on cloth or paper, for models of airplanes or trains, for showing historical events and for hundreds of other subjects which you will enjoy discovering for yourself.

A school project in geography or history or science can be carried out with the help of soap carving. Let us suppose that you are studying the sixteenth century and that the class decides to make a museum of objects belonging to that century. First you will read all you can about this period of history in your school books or other books that you will find in the library.

You will also find it useful to consult your BOOK OF KNOWLEDGE. The sixteenth century was part of the period known as the Renaissance in Europe—a period about which we tell you in several articles. Open your BOOK OF KNOWLEDGE to the General Index, which is in Volume 20. Look up the headings of Renaissance, Renaissance architecture and Renaissance art. Read carefully all the articles to which the Index refers you. Look at the pictures in these articles and you will be able to find a variety of interesting ideas for your project.



Some more interesting specimens of soap sculpture. Note the two effective examples of bas-relief work.

If there is an art museum in your town, you will also find it worth while to go there and to study the statues and paintings which go back to the time of the Renaissance or which deal with Renaissance subjects. Most museums have quite a good deal of material of this particular kind.

You will now be ready to start work on this project. You may want to copy a famous statue by Michelangelo or Bernini or some other great sculptor of the period. You may choose to carve some famous building or other—the Tower of Pisa or a Venetian palace. The Tower of Pisa will make a fine subject; you can carve it from a single bar of soap. Perhaps you may prefer to show men and women dressed in the beautiful costumes of the Renaissance period.

THE GAME OF ICE HOCKEY

ICE hockey is one of the speediest and most thrilling of sports; it is a favorite in the United States and Canada. The game is played on a sheet of ice called a rink; upon this the players skate. The rink is 200 feet long by 85 feet wide, or as near to these dimensions as possible. It is surrounded by a wall or fence of wood, not more than 4 or less than 3 feet high.

In the diagram on this page we show you the goal lines, the penalty shot lines, the blue lines, the center ice circle, the center line, the face-off circles and the goal creases. The goal posts consist of two upright posts, 4 feet high and 6 feet apart, connected by a crossbar extending from the top of one post to the top of the other. A framework extends from these posts several feet behind the goal line. A net is stretched on this framework in such a way that only the space bounded by the two goal posts and the crossbar is left clear.

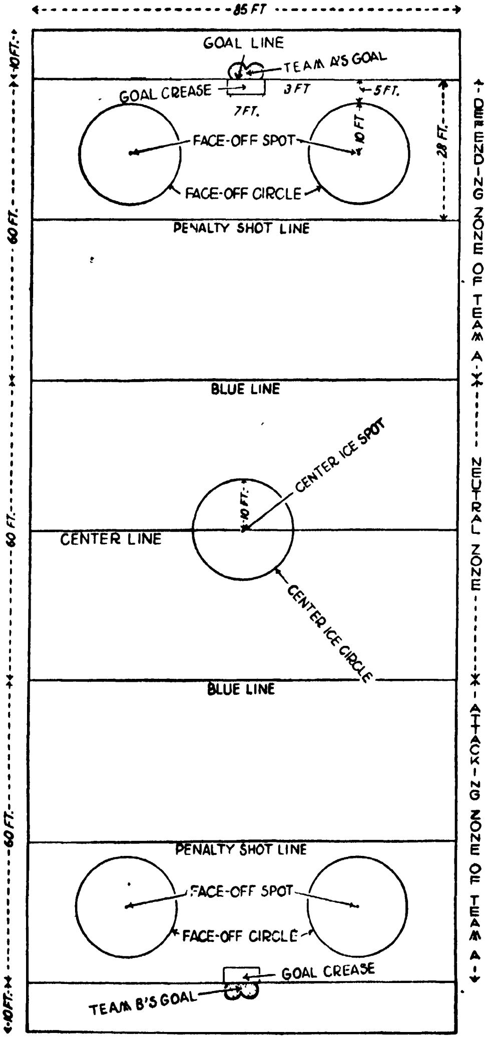


Diagram showing the layout of the ice-hockey rink.

You will notice that the blue lines, which are 12 inches wide and are marked out on the ice in blue, divide the playing surface into three areas, each 85 by 60 feet, called zones. The area in which the goal is situated is called the defending zone of the team defending that goal. The central area is the neutral zone; the other, the attacking zone.

Benches for players are set at either side of the rink, toward the center. The rink is also provided with a penalty bench large enough to seat 8 persons. It is for the use of players against whom penalties have been called, as well as for the officials known as the game timekeeper, the penalty timekeeper and the official scorer.

The shaft of the wooden hockey stick used in the game must not be longer than 53 inches; the blade must not be longer than 14¾ inches. The puck used in play is a disc of vulcanized rubber; it is an inch thick and has a diameter of 3 inches.

NAMES OF THE PLAYERS AND OFFICIALS IN THE GAME OF ICE HOCKEY

Each team is made up of six players: the goalkeeper, the two defense men, the center and the two wings. Nine substitutes are allowed on each team during a game. The goalkeeper protects his legs with wide pads, extending from his ankles to above his knees. All players wear long and thick gloves. Some players wear helmets.

There are six officials. The *referee* has general charge of the game and imposes all penalties. The *linesman* rules on offsides and puts the puck into play. The *umpire* decides whether or not a goal has been scored. The *penalty timekeeper* checks the time that is served by penalized players. The *official scorer* keeps a record of the goals scored, assists and penalties. The *game timekeeper* sees to it that the periods do not exceed the time limit set for them. Each of these officials plays an important part.

Each team tries to put the puck into its opponent's goal as often as possible and at the same time tries to prevent the opponent from scoring. There are three 20-minute periods of actual play, with a 10-minute intermission between the first and second periods and the second and third periods.

The home team has the choice of goals at the start of the game. Goals are changed after each period.

The game is started by a *face-off* in the center of the rink, at the center ice spot. Two players, one from each team, face each other with their right sides toward their own goals; the stick of each player must be on the same side of the center ice spot as his own goal. The linesman *faces the puck* by dropping it on the ice between the sticks of the two players. The other players must keep outside of the center ice circle and must stay between the puck and their goal lines. The face-off at center ice takes place after a goal has been scored and also at the beginning of each period.

Once the face-off has taken place, the play consists of carrying the puck along the ice with the hockey stick; of dribbling (that is, sending the puck forward by a series of strokes); of passing the puck to one's team mate; and of shooting in order to drive the puck through the opponent's goal.

THE DIFFERENT WAYS IN WHICH A GOAL MAY BE SCORED IN ICE HOCKEY

A goal is scored when the puck is shot completely across the goal line, between the posts and under the crossbar, by the stick of an attacking player. If the player passes the puck to a teammate who then scores a goal, the first player is credited with an assist. If an attacker hits a defender with the puck and the puck goes into the goal, the score is allowed. A goal is also scored if the puck is put into the goal in any way by a player of the defending team.

Each goal counts as one point; the team that scores the greatest number of points wins the game. If the game is drawn after three 20-minute periods, play is continued for an extra period of 10 minutes. If the score is still tied at the end of that time, the game is called a draw.

A number of penalties are provided for violating the rules of the game. There are five kinds of penalties in all: (1) minor penalties; (2) major penalties; (3) match penalties; (4) misconduct penalties; (5) minor and major penalty shots.

When a minor penalty is called, the player must leave the ice and sit on the penalty bench for two minutes; during this time his team must continue to play without him, as no substitute is permitted to take his place. Minor penalties are called for holding a puck for more than 3 seconds; holding an opponent; tripping and charging; interfering with an opponent not in possession of the puck; deliberately shooting the puck out of the rink; hooking or slashing with the blade of one's stick.

When a major penalty is called, the player must leave the ice for 5 minutes without a substitute; if a second major penalty is called on the same player, he must leave the ice for 10 minutes; he must leave the game for a third offense. A major penalty is called when a player charges into an opponent from behind; charges the goalkeeper while the latter is in the goal crease; throws his stick; knocks an opponent into the fence; injures an opponent by carrying his stick above his shoulder; starts a fist fight.

When a misconduct penalty is called, a player is suspended for a period of 10 minutes or longer. A substitute is permitted to replace the player in question. A misconduct penalty is called for insulting or attacking an official; throwing a broken stick among the spectators; interfering with a penalty shot. (See below.)

If a player deliberately tries to injure an opponent, a match penalty is called. The player is suspended for the rest of the game; no substitute is allowed to replace him for 20 minutes.

If a player in possession of the puck is tripped or otherwise fouled and thus prevented from having a clear shot at the goal, his side is given a minor penalty shot if the offender was the goalkeeper; a major penalty shot, if the offender was any other member of the defendnig team.

HOW MINOR AND MAJOR PENALTY SHOTS ARE PLAYED BY THE ATTACKING TEAM

In a minor penalty shot, the puck is placed by the referee on the center ice spot. One of the players of the team that was fouled takes his place beside the puck; the goalkeeper of the team that fouled stays in his goal crease. The other players must withdraw to the sides of the rink.

The player standing beside the puck now carries it along the ice with his stick and fires it toward the goal before reaching the penalty shot line. In a major penalty shot, the player of the team that was fouled plays the puck from the blue line of the defending team and does not have to fire the puck from behind the penalty shot line.

After a minor or major penalty shot has been taken, the puck is faced at center ice in the usual way if a goal has been scored. If a goal is not scored, the puck is faced from one of the face-off spots. All players,

Courtesy, Madison Square Garden

Defending players (striped stockings) try to ward off a goal as their goalkeeper (1) lies helpless on the ice.

other than the two taking part in the face-off, must stand outside the face-off circle.

When the game is stopped because of a penalty or for some other reason, the puck must be faced where it was last played. If the puck goes off the rink, it is faced on the spot from which it was shot. When a foul occurs behind a goal, the puck is faced at the face-off spot nearest the place where the foul took place.

Substitutes may be sent in at any time from the players' bench, providing that the player leaving the ice shall be at the players' bench and out of play before the substitute begins to take part in the game.

The puck may be passed forward by any player to a player of the same side in any one of the three zones. Generally speaking, the puck must not be passed forward from a player in one zone to a team mate in another zone. However, players on the defending team may make and take forward passes from their own zone to the center line, providing that the pass is completed before the puck reaches the center line. In the case of an illegal pass, play is stopped and the puck is faced at the spot from which the pass was made.

The players on the attacking team must not precede the puck into their attacking zone. If they do, the puck is faced in the neutral zone, 5 feet from the line dividing the neutral zone from the attacking zone.

An attacking player must not enter the defending side's goal crease unless the puck is in the crease.

Players are allowed to kick the puck. But a goal can not be scored by kicking a puck into it unless the puck first hits a defending player other than the goalkeeper.

The puck must be kept in motion at all times. A side in possession of the puck in its own defense area can carry it behind its own goal once; then the puck must be advanced toward the attacking team's goal. A minor penalty is imposed on the defending team for violating this rule.

No defending player, except the goalkeeper, is allowed to fall on the puck when it is within his own goal crease. If this rule is violated, a penalty shot is awarded to the attacking team.

The goalkeeper is not permitted to hold the puck in his hands or arms for more than 3 seconds. He must not throw the puck forward toward his opponents' goal, or drop it into his pads, or throw or bat the puck into the spectators' seats. If any of these rules is violated, the attacking side is granted a penalty shot.

If the players fall on the puck in such a way that it is completely out of sight of the referee, he blows his whistle and stops the play. The puck is then faced at the point where the play was stopped.

THE NEXT THINGS TO MAKE AND TO DO ARE ON PAGE 6549.

BUTTERFLIES AND MOTHS

Pictures, © H. B. Gray, Long Beach, Calif.

1. A swallowtail butterfly lays an egg and cements it in place on a leaf of sweet fennel.

HUMAN genius has never invented anything lovelier than a butterfly, nor anything so wonderful. In the lore and legend of the ancients, in the fairy tales beloved by us all, nothing exceeds the surprise, the startling succession from repulsiveness to dainty charm, of this creature's strange career.

It is a delightful fact that any child may observe for himself the entire amazing life-cycle of these little wonder people of the gardens and the wilds. You can see it all, and if you have a camera you can photograph each step in this wonderful life-story. It begins with the tiny egg which the mother butterfly or moth deposits upon a branch (each kind seems to prefer its own special kind of plant, or tree). From the egg hatches a tiny wormlike grub, which grows into a caterpillar with an enormous appetite. You can feed it with its favorite leaves and watch it grow too big for its skin. You can take pictures as it spins a case around itself, and goes to sleep. One day, you can see the covering of the case split open. Out comes a winged thing of the air, lovely as a floating flower—a perfect butterfly or moth.

Men who have studied the subject all their lives have sought to classify the eggs, in the hope of recognizing species by them, but the attempt fails. Take the eggs from their natural surroundings and mix them with others, and they are hopeless as a guide. And the difficulties go deeper than that. There are times when, in the presence of the perfect insect, we are puzzled to say why one is a butterfly and another a moth. It is simple enough to distinguish between a clothes-moth and a cabbage-haunting butterfly; but there are features in which moths so closely approach the butterflies as to make it a delicate matter to define the border line. As a matter of fact, the border line is much less sharply drawn by Nature than by entomologists. We who have followed this study have seen how one form emerges in another. And so it is here again. There are definite formulas to guide us, but there are many exceptions to remind us how difficult it is to draw sharp lines between the two.

First then, a butterfly flies by day, a moth by night. That holds good to this extent, that butterflies never fly by night; but, as against that, there are many moths which fly by day. In warm latitudes, where bats and other night-flying enemies of insects abound, moths which fly in the hours of darkness are rarities.

Another rule is that butterflies have their antennæ thickened at the ends, after the manner of little clubs, while moths have their antennæ fringed or feathered. But we look at a Burnet moth through a microscope to find thickened antennæ-ends here, and are reminded again that our law is not without exceptions.

Rule number three is that the butterfly when at rest raises its wings over its back so that they are at an angle of 90 degrees to the body; whereas the moth rests with its wings down, like the roof of a house, with the rear wings hooked to the front pair. Yet some Skipper butterflies when resting flatten out their wings moth-wise, though they are free of the hook-and-eye attachments.

THE GENERAL NAME FOR BUTTERFLIES AND MOTHS IS LEPIDOPTERA

The ugly word *Lepidoptera* is the scientific name given to the whole order of moths and butterflies. It tells in a single group of letters the magic of the butterfly's glories. All these insects have their wings covered with scales, and the scientific name means "scale-winged."

There is mystery about the eggs of moths and butterflies. It should be advantageous for the eggs to lie unobserved by creatures to which an insect egg is dainty food. Yet eggs of the moth and butterfly are as exquisitely beautiful as gems—lustrous as pearls, more delicate than hand-wrought jewels. They are fluted, ribbed, patterned in a score of different ways—perfect as works of art, yet contrived with marvelous skill for the admission of the substance which renders them fertile. The material of which the eggs are made also provides the larvæ with their first meal after they have hatched from the shells.

Such beauty as this, we might think, would make the eggs conspicuous and so expose them to danger; there is safety in obscurity. But since only a small part of the thousands of eggs laid do survive, the charm of form, texture and coloration must be accepted as another evidence of Nature's desire for beauty.

HOW DO THE PARENT INSECTS KNOW WHERE TO LAY THEIR EGGS?

A second element of mystery about the eggs is how the parents know where to lay them. Boy and girl collectors know where to look for the eggs or larvæ of a species. They know what to expect from the dead nettle, from the privet, from the linden, from the cabbage, from the oak and the apple; because moths and butterflies are true to their habitat, that is, almost every species has a favorite plant on which it lays its eggs.

The grown-up insect goes back to the plant or tree trunk on which it was nurtured in its early life. This is wonderful. No moth or butterfly eats. At most it drinks the nectar of sweet-tasting flowers, or, as in the case of the Red Admiral, sips the juices of decaying flesh or the muddy water of a puddle. But it has no need for solid food. It has no mouth parts for such food; some moths and butterflies can not even take moisture.

THERE IS USUALLY ONLY ONE FOOD FOR EACH SPECIES

Yet all lay their eggs on a substance which will be cradle and larder to the caterpillars into which those eggs will hatch. It is always the right food for the particular eggs. Some caterpillars, however, are such lusty fellows that they thrive on almost any sort of diet, and can go from one plant type to another without ill effect. Generally, however, there is one food, and one only, for a species. If that fails, the caterpillar will die in the midst of abundance, starving when caterpillars of other species are flourishing. The parents, to which solid food is not necessary, find it without fail for the offspring which the parents may never live to see.

Between the caterpillar stage and that of the grown-up insect there is a strange period during which it seems to be dead, and the desire for food is lost. This is the chrysalis stage. Yet Nature, by some magic, guides the parent to the right tree, bush or weed. There, on the very substance essential to the creature yet unborn, the egg is laid. There is no more perfect example in the world of unerring instinct.

The eggs may be laid singly, in clusters or in masses, according to the species.

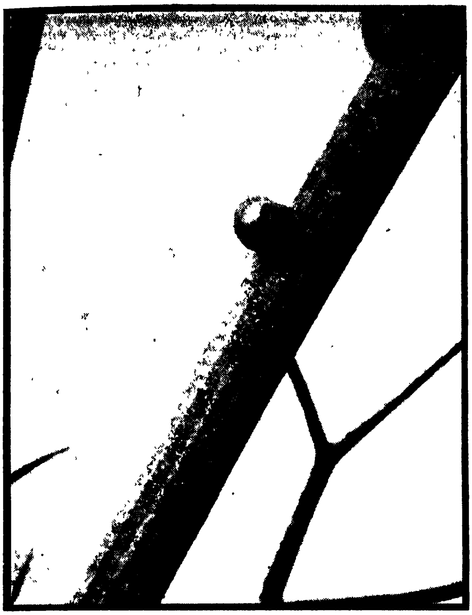
After the appointed length of time the larvæ, or caterpillars, hatch out of the eggs. In some species they hatch in a number of days, in others the egg is buried underground or covered with a coat of varnish, and survives the winter, hatching out the following spring.

The caterpillar is tiny, in comparison with the grown-up insect, when it first comes out of the egg. It may be smooth or spiny or hairy or all by turns. It may be armed with sharp prickles. Except that it has a very complicated head, with tough, horny jaws, eyes and feelers, it might be a worm with legs.

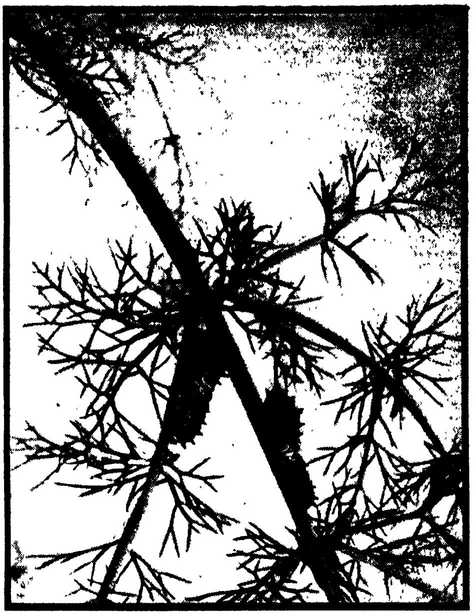
THE ENORMOUS APPETITE OF THE CATERPILLAR

Yet how different is its career from that of the worm! Having eaten the shells of the eggs from which they emerge, the caterpillars begin a campaign of gorging and

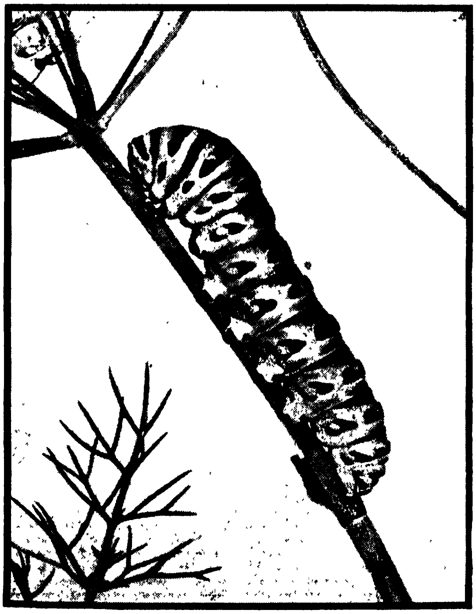
THE CATERPILLAR'S ENORMOUS APPETITE



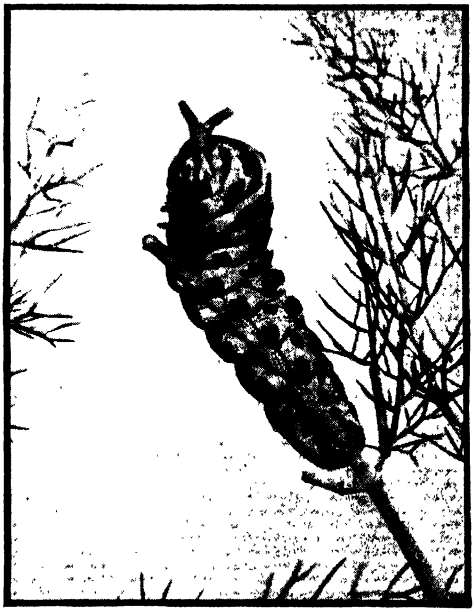
2. The egg, cemented to the branch of sweet fennel, is the size of a large pinhead. It is pale yellow at first, but soon changes to green. Now, because it is so very small and is colored like the plant on which it lies, it cannot easily be detected.



3. From the egg is hatched a grub, or caterpillar, with a spiny black coat. First it eats the eggshell. Then it starts an astonishing career of eating the plant upon which it lives. It gorges until its skin becomes too tight and splits off.

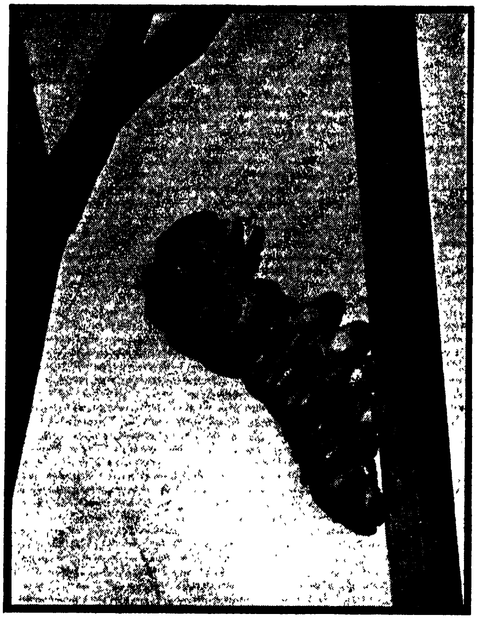


4. After ten days of eating and shedding its spiny skin, it comes out in a smooth green and black skin with orange spots. Now it eats more than before, and casts its skin whenever it becomes too tight. The thirteen pictures on these pages tell the life-story of the swallowtail butterfly.

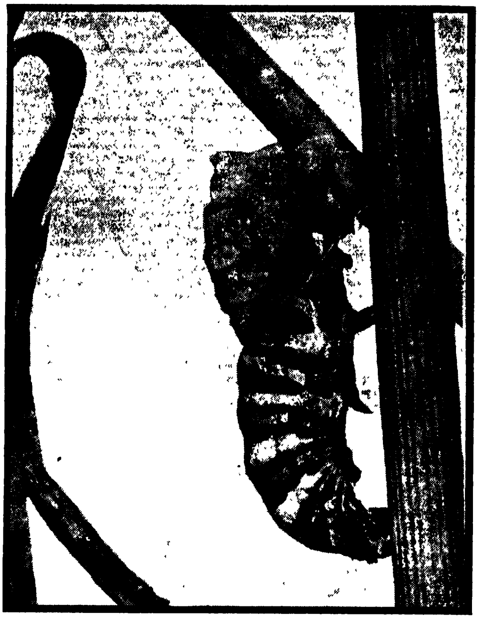


5. The swallowtail grows a pair of hollow horns, called ejectors. When irritated, the caterpillar throws the fore end of its body from side to side, and protrudes the horns. From them comes a sharp odor which probably keeps some of its enemies away. Not all caterpillars have this protective weapon.

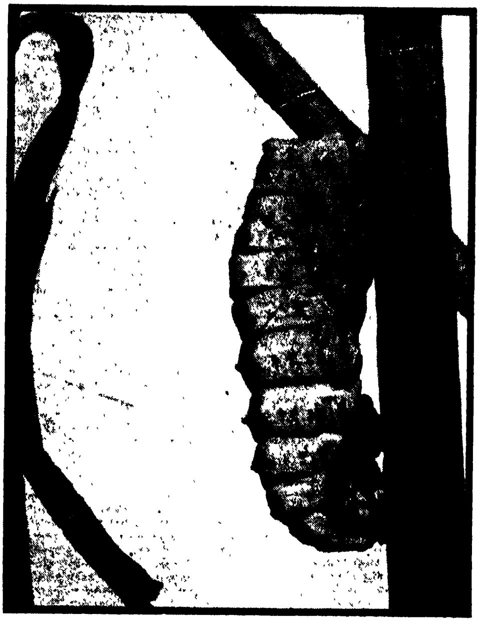
THE LIVING DEATH OF A CATERPILLAR



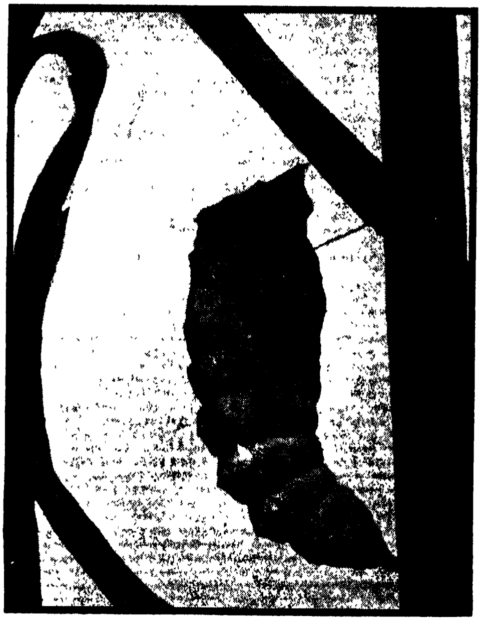
6. From a gland in its body it spins out a silken thread, cementing the ends to the stalk of the plant. It ducks into the loop and wriggles until the loop is around the middle of its back. Here it pushes against the thread to test its strength.



7. It casts its skin for the last time, without disengaging the body from the supporting loop of silken thread. What emerges is no longer a caterpillar but a chrysalis, or pupa. You can see how the skin splits down the back, beginning at the head.

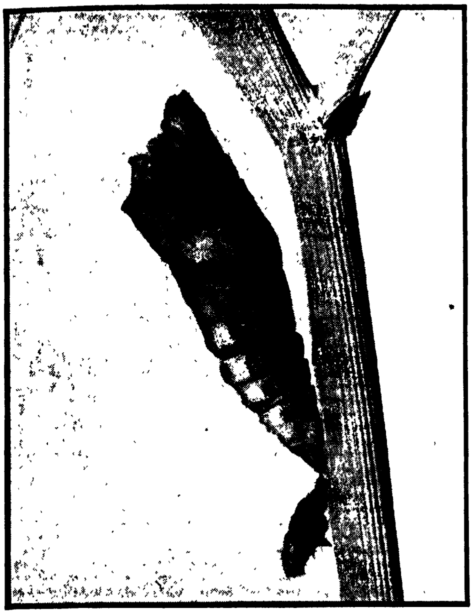


8. Slowly the chrysalis frees itself from the old caterpillar skin, first the head, then the tip of the abdomen. This is the most difficult moment of all. The tip of the abdomen (called the cremaster) now fastens like an anchor on the stem. The chrysalis is almost ready to begin its period of "living death."

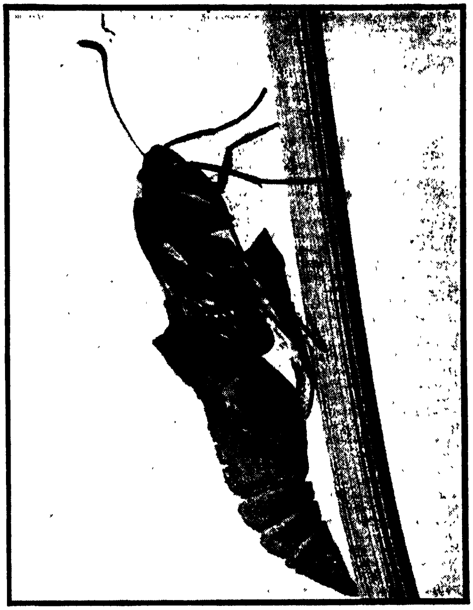


9. The chrysalis at last hangs from the plant supported by the loop of silk and the tip. It is soft and helpless, gray in color, and as it hangs, looks like a dead leaf. The outside is called a pupal case. This gradually dries out. The pupæ of moths rest snuggly in cocoons. Butterfly pupæ do not have cocoons.

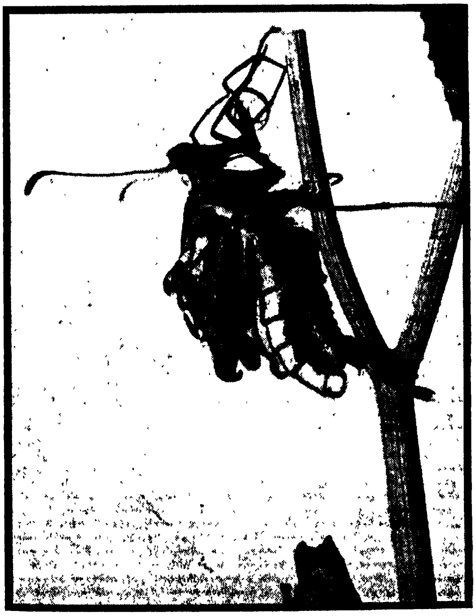
A BUTTERFLY IS BORN



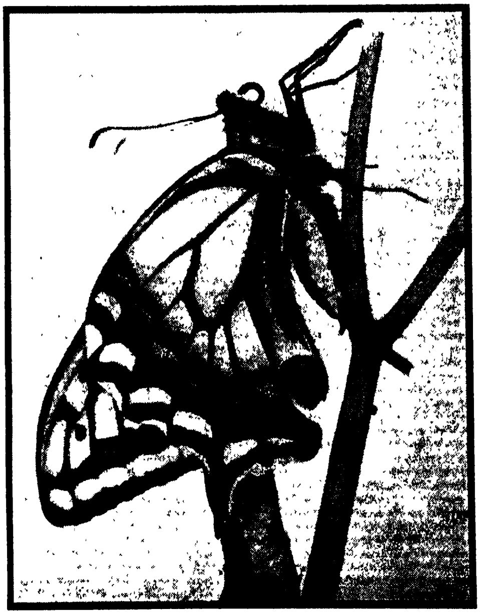
10. The chrysalis seems to be dead, but inside the shell something very wonderful is happening. The internal parts soften into a kind of "soup," from which is formed the body of a butterfly. Then the pupal case cracks and the butterfly pushes up one end.



11. Slowly the butterfly works itself out of its cradle. Here it is almost free from the pupal case. All six legs are out. The wings and abdomen are still imprisoned and the insect must fight to free them. It is a difficult moment for the new insect.



12. The insect is free, but soft and damp and weak. After a short rest the butterfly feebly moves its wings until they unfold. It also flexes and coils its tongue in preparation for its liquid meal of nectar. It has lost all memory of its former life as a greedy caterpillar.



13. Two hours have passed since it freed itself from the old pupal case. The perfect butterfly is ready for a trial flight, its body hardened, its tongue coiled up in place, its wings expanded and beautiful. The butterfly is called an imago, meaning a true picture of its own perfection.

almost burst with food. There are no other words for it. They live to eat. Behind the head are three pairs of jointed horny legs and claws which serve mainly to grip the food on which the larva feeds.

THE MANY PAIRS OF LEGS THE CATERPILLAR HAS

These legs occupy that part of the body which will be the chest, or thorax, of the butterfly, and from which three pairs of legs and two pairs of wings will grow. From the rear part of the caterpillar's body spring several pairs of fleshy false legs—pro-legs, as they are called—which will vanish in the chrysalis stage. Behind these are two claspers at the end of the body.

These claspers play an important part in the activities of the Geometer caterpillars, commonly known as spanworms. Here the larva, instead of marching forward with the flowing motion of ordinary caterpillars, arches its body. Then, gripping by the claspers and pro-legs, it throws itself forward, retaining its grip in the manner described until the fore part of the body has reached a new position.

Like most other insects, caterpillars breathe by means of air tubes which open onto the surface of the body. These we may see for ourselves along the sides of the body. The grub dies if these are sealed, and so it is a matter for wonder that the poor thing does not meet with disaster when the time comes for it to molt. For the caterpillar does molt; its entire skin must be cast off, again and again.

HOW THE CATERPILLAR CASTS OFF ITS TIGHT SKIN

It eats and eats till it can eat no more, till the body has grown so great that its skin must burst. As the time of this crisis approaches, the grub becomes sluggish and its appetite fails. It seems rather to be dying than growing a new jacket, so ill is it. But at the appointed moment the skin splits down the back, and out crawls the caterpillar with a new and lustrous skin which is already in position beneath that which it has outgrown.

Appetite again returns, and once more the caterpillar gorges itself. The amount of food eaten is truly enormous. The Privet Hawk-moth caterpillar devours 11,000 times its own weight in food during its larval life. The larva of *Polyphemus* consumes three-quarters of a pound of leaves and half an ounce of water during its lusty two-months' career—a quantity equal to 86,000 times the weight of itself when hatched. (This species is often called the American silkworm.)

The caterpillar of the Goat-moth finally reaches a weight 72,000 times as great as its weight when newly hatched from the egg. The Goat-moth caterpillar is one of the marvels of the insect world. Its egg is laid in a chink in the bark from where, when hatched, the larva works into the tree, gnawing a way before it as it goes.

At first its tunnelings are small, like itself, but as time goes on these become so long that at the end of three years the caterpillar has done serious damage to the tree which was its home and its food.

We find caterpillars in the wood of many trees, in reeds and down in the soil among roots, but mainly on the green leaves of vegetation.

THE CATERPILLARS' BEAUTIFUL MARKINGS SERVE AS THEIR DEFENSE

For defense, most caterpillars depend upon a protective resemblance to their surroundings. The beautiful markings of the Hawk-moth caterpillars harmonize extraordinarily well with the colors of their home among green leaves flecked with light, and so do the color schemes of hundreds of other caterpillars.

Those that are less protected by color return to the soil when day dawns, tunnel the leaves and live there, or a number of them spin a tent of web and live in it together. Other larvæ are protected from their enemies by poisonous hairs.

Then there are the Leaf-rollers which cement together two edges of one leaf or two different leaves, and in the little room thus formed make their home, snugly furnished with a couch of web spun from their silk gland. One end of the retreat is left open and from that, at the first sign of danger, they back out, spin a strand of web, and so descend on the strand out of harm's way. Many other caterpillars have the same reliance on this self-furnished life-line. Sometimes we can see hosts of them lowering themselves from linden, poplar and oak, swaying on the ladders of silk which are being spun before our eyes from the gland each one has beneath its head.

THE CATERPILLAR THAT SPITS POISON LIKE A LITTLE SNAKE

When in danger, the poisonous species distil venom. A mere touch will cause poison to flow from some of them, but others, such as the Puss-moth larva, spit out their poison a considerable distance, like little snakes. These caterpillars are to be avoided for the fluid causes blistering on a sensitive skin.

Whatever the kind of larvæ, the great hour comes for change. The last meal has been eaten; the caterpillar must prepare for the supreme marvel of its life. It is to become a chrysalis. With the butterflies the outer skin is cast off, the grub weaves a wisp of silk around its golden self, and sleeps. But the moths wrap themselves in elaborate coverings of silk.

THE MOTH THAT GOES TO SLEEP IN A CLOAK OF BUBBLES

The Woolly Bear caterpillars weave their now useless hairs into their silken cocoons; the larvæ of the *Dicranura* chew such difficult material as wood and even sandstone, and mix that with their silk. Most wonderful of all, an African moth of the *Nyctemera* group wraps itself in a cloak of bubbles that it blows itself, and then goes to sleep.

Some moths and butterflies lay two batches of eggs a year; others only one. In most cases the earlier batch of eggs will develop into grown-up insects the same season. Those laid later in the year may carry the cycle as far as the chrysalis stage. In this they will remain all winter. A few species require more than one year to develop.

SOME CATERPILLARS THAT SLEEP THROUGH THE WINTER

The caterpillars of the Goat-moth, the Hawk-moth and others sleep through the winter. The writer had an experience with 250 Tiger-caterpillars, which were accidentally starved for two weeks at a critical time in their lives. They survived, thin and miserable, resumed feeding at Christmas, and completed their change in the following year.

Within the cocoon, a marvelous transformation takes place. But we do not always permit this to happen with the majority of the Silk-moth cocoons. This moth, however, has become an entirely domesticated species, bred in captivity. The females do not seek to fly away, nor the caterpillars to wander, but rest in the place where they are hatched and fed.

Silk of unmatched quality is produced by these caterpillars. It is woven, scores and scores of yards of thread to a single cocoon, to form a rest and refuge while the change from grub to moth is made. Only a sufficient number to keep up the supply of eggs is permitted to undergo the complete change. The remainder, when the cocoons are spun and the caterpillars are asleep inside, are steeped in hot water which destroys life and leaves the human owner to unwind the thread and weave it into silk.

HOW THE GREAT PASTEUR FIRST SAW A SILKWORM COCOON

During the second half of the nineteenth century, disease attacked the European Silk-moths. One of the most important industries of two great nations (France and Italy) was threatened, and Louis Pasteur, the great French scientist, was called upon to find some way of checking the disease. He had never seen a cocoon and knew nothing of the life story of the insect. He went to Henri Fabre, the naturalist, and asked to see the cocoon which he understood the caterpillars formed.

Fabre handed him one. Pasteur shook it near his ear and said with surprise: "Why it makes a noise; there's something inside."

Fabre explained that it was the chrysalis, and Pasteur asked him what he meant. "I mean the sort of mummy into which the caterpillar changes before becoming a moth," answered the famous old naturalist.

"And has every cocoon a chrysalis inside it?" asked the astonished scientist.

"Obviously," replied Fabre; "it is to protect the chrysalis that the caterpillar spins its cocoons."

Pasteur studied and toiled, mastered the subject, and stamped out the disease which had baffled Fabre and all the other naturalists. Prosperity returned to the silk trade of Europe.

Yes, the cocoon is to protect the chrysalis during the great change. A lowly grub sheds its skin for the last time, spins the cocoon around itself and lies like a hibernating or paralyzed animal. It is still and helpless, so cold that you think it dead unless you hold it in your warm hand and see it faintly wriggle. But as it lies motionless in the cocoon, a miracle is taking place.

THE CHANGES WE MIGHT SEE TAKING PLACE ON THE BUTTERFLY'S CHRYSALIS

Nothing remains unchanged, save perhaps its system of breathing. Jaws, claws, claspers, pro-legs, digestive system, even the very shape, all disappear. Yet if we were to watch patiently the horny case of the chrysalis of a butterfly (made of a substance called chitin), we would see something wonderful happen before our very eyes. The shapes of the head, legs and thorax gradually appear upon the chrysalis case, the spiracles (the openings through which the grown-up insect will breathe) show themselves along the sides—the first rough draft of Nature's work is dimly seen on the horny case of chitin.

THE FULL-GROWN MOTH OR BUTTERFLY COMES FORTH FROM THE CASE

The hour arrives for the insect to wake and to come out of its cocoon. The case is slowly forced apart from within. Out of the husk comes a trembling, feeble creature. The ugly grub has vanished; in its place is a lovely winged moth or butterfly as colorful as a flower. At first the wings are strangely doubled and bent and their scales are all standing upright. Like the flies, the moths and butterflies are fully developed when they leave the chrysalis. There is no growth afterward for them, whether they are tiny moths of the leaf-mining group, a mere eighth of an inch across the wings, or the giant Atlas-moths of Africa, the Titans of all the *Lepidoptera,* which have a wing span of nearly one foot!

Courage and strength come. A rush of blood sweeps from the central supply to the veins of the wings, which straighten out and become strong. The scales, packed, as we first see them, to save space in the prison of the chrysalis, settle into their correct positions. The effect is as if new color and radiance had suddenly descended on the new creature.

THE COLOR GLITTERING ON THE WINGS COMES FROM LIGHT ON TINY SCALES

The color we seem to see on these glittering wings is not pigment; it is the effect of light reflected by the scales as if they were so many tiny diamonds. The colors rival those of the most gorgeous humming-bird, the vainest peacock, the gayest flower; and all this brilliance of color is only the effect of light. Butterfly beauty is indeed light shattered on scales too fine for the unaided eye to see apart from one another.

Nor is this the end of the tale of beauty and wonder. Butterflies have rightly been called "aerial flowers." Many of them have sweet odors.

Not all butterflies have this odor. In some cases scent glands are in certain patches; in others they are widely scattered. The scales of the wings include feathery scent scales, from which perfume is given off, apparently at the will of the owner. We suppose that to be so from the fact that the scent glands communicate with air tubes, by means of which pressure can be exerted to scatter the pleasant odor as the butterfly desires.

Fritillaries have the scent organs on the fore wings; the Meadow Browns and their closest kin have them on the discs of the fore wings; the Skippers also have scent patches, in varying positions for different species.

IT IS THE MALE BUTTERFLIES THAT ARE SWEETLY PERFUMED

In human society it is women who delight to wear perfume, but in nature we find only the male butterflies able to create a sweet atmosphere with which to attract the opposite sex. The female can easily trace her scented suitor, but how can he trace her? There we have another mystery of the *Lepidoptera.* There seems no doubt that they have means of communication unknown to us. A naturalist makes a female moth a prisoner in a tiny open-fronted cage, out in his garden at night, when none of her species appears to be within range. Males flock at once to her dungeon from all quarters of the compass. How do they know, out of sight, out of hearing, that she is there?

It can not be sight, for though moths' eyes are large, and the insects fly well in the dark, the things they see are such as reflect the little light available. All the white flowers which open and scent the air at night are moth lighthouses, stored with nectar for them. Even human beings, with their different eyes, can see white in comparative darkness. But could a moth see another moth in a distant cage? No, it can not be vision that draws wooers to the cage.

Some students believe that insects in general, and moths and butterflies in particular, have their own natural equivalent of our radio. It is clearly proved that a bat, deprived of eyes and hearing, still receives impressions on its skin which enable it to avoid the smallest obstacle in flying.

If bats are so highly specialized, and so unexpectedly, then why should not moths and butterflies be equally specialized in another direction? They may be sending out cries which our ears are too dull to catch, and their antennæ may be the aerials to arrest the sound waves so created. We may never know the secret.

THE WINTER-MOTHS THAT LEARNED HOW TO OUTWIT MEN

The co-operation between the two sexes brings strange things to pass in the world of these insects. Quite a new thing has happened in this connection within the lifetime of the editors of this book, and the detested Winter-moth is the hero.

Female winter-moths are wingless. They lay their eggs on the branches of fruit trees and then die. The caterpillars devour the leaves; then, when about to undergo their change, they descend to the ground and bury themselves in the earth or in crannies in the bark of the tree.

HOW THE FRUIT-GROWERS TRIED TO DESTROY THE WINTER-MOTH

The new generation of males, when they leave the pupa stage (another name for the chrysalis stage), fly like other moths; but the females, in order to lay their eggs, must climb the tree trunks, like caterpillars. To prevent them from climbing up and laying their eggs in the branches, which ruins the trees, fruit-growers place bands of paper, heavily smeared with a thick sticky substance, around the trunks of the trees. This catches thousands of the crawling females.

At times their numbers are so great that the females of the winter-moth are able to crawl over their dead to the boughs beyond. Where banding has been generally practiced for some years on fruit farms, the winged males have been seen carrying females *to the tops of the trees!*

SOME OF THE COMMON BUTTERFLIES THAT WE SHOULD KNOW

The meadow browns, or satyrs, are slow in developing and are also slow on the wing. The commonest of the meadow browns are: the pearly eye, which loves the moist woods; the eyed brown, generally found in grass along the streams; the white mountain butterfly, which often requires two years to mature; and the Arctic satyr, which lives in the Far North.

The zebra is an interesting tropical butterfly that migrates to the Gulf states. It is sometimes four inches across the brownish black wings, which are barred with yellow stripes. It roosts in flocks in the woods.

The hairstreaks, of which there are about fifty kinds, belong to the same family as the coppers and the blues. All are dainty and delicate and very lively.

The monarch, or milkweed, butterfly is a gorgeous fellow. We must also speak of the viceroy, which closely resembles the monarch. Both are reddish brown, with black bands and white dots. The viceroys, some of which emerge from their chrysalises in the autumn, also lay eggs the same year; and the caterpillars, after they hatch, build little houses from leaves and live through the winter in them, coming out as butterflies in the spring. The vicereine, found in the Gulf states, resembles the viceroy except that it is darker. The banded purple and the red-spotted purple are closely related to these. More than seven thousand species of Lepidoptera are found in North America north of Mexico. So you see that we can not even give the names of very many.

Nearly every moth and every butterfly performs useful service, either by fertilizing the vegetable growths from which it draws its food supplies or by some other helpful act. Every destructive group of caterpillars has its cousins at work for the good of our soil. Yet every year we have caterpillar plagues of some sort. In small gardens it often happens that the large and small white cabbage butterflies produce so many eggs that the caterpillars destroy every cabbage.

The pea moth injures our peas, in which we find its larvae; there is the codling moth whose caterpillar tunnels into our apples and causes them to topple at the first gust of wind; there is a moth that haunts the foliage of our currants, another that tunnels them; a moth that bores into corn stems.

Indeed, we have scarcely a single growth in forest, garden or field that does not have a hungry enemy in the shape of caterpillar from moth to butterfly. Caterpillars are the cause of huge loss to the farmer and fruit-grower; they cause unending disappointment and dismay to those whose joy is a garden; and thousands of shade trees are stripped by tent caterpillars each year.

THE STRANGE MIGRATIONS OF SOME BUTTERFLIES

Yet the story of the moths and the butterflies remains one of the strangest and most interesting in Mother Nature's book. The question of their migration, for instance, is extremely mystifying. Regularly, whole swarms of certain butterflies leave the continent of Europe and fly to the British Isles and even farther. Sometimes only a few arrive.

Clouds of butterflies have been seen streaming out to sea from South America. They have also been seen bravely flying twelve hundred miles from the nearest possible land, Africa. The force of an overwhelming air current may be responsible for such great flights as these, but no one can be sure. In America the monarch apparently follows the birds south in the autumn and returns in the spring.

THE NEXT STORY OF ANIMAL LIFE IS ON PAGE 6623.

How Do Moth Balls Keep Moths from Destroying Our Furs and Woolens?

MOTH balls used to be made of camphor, and were then sometimes called camphor balls. Nowadays they are generally made of naphthalene, or of some other petroleum product. All of these substances are alike in one way—they are volatile. That is, whether you have them in solid or liquid form, they readily turn into a gas and mix with the air around them. Also, this gas is deadly to the insects that we call clothes-moths.

When the time comes for the female moth to lay her eggs, she chooses something made of wool or fur to lay them in. Soon the eggs hatch out tiny, worm-like creatures called larvae, and the larvae feed themselves by eating the cloth or fur. If the clothing is kept packed with moth balls or flakes or crystals, or sprayed with a liquid preparation of naphthalene, the gas gets into the clothing and forms an invisible cloud around it. This gas will kill any moths that are about, and it will also kill the larvae—even before they have been hatched from the eggs. After a time the gas will float away into the outer air, and more moth balls or crystals or spray must be used on the clothes.

THE NEXT WONDER QUESTIONS ARE ON PAGE 6554.

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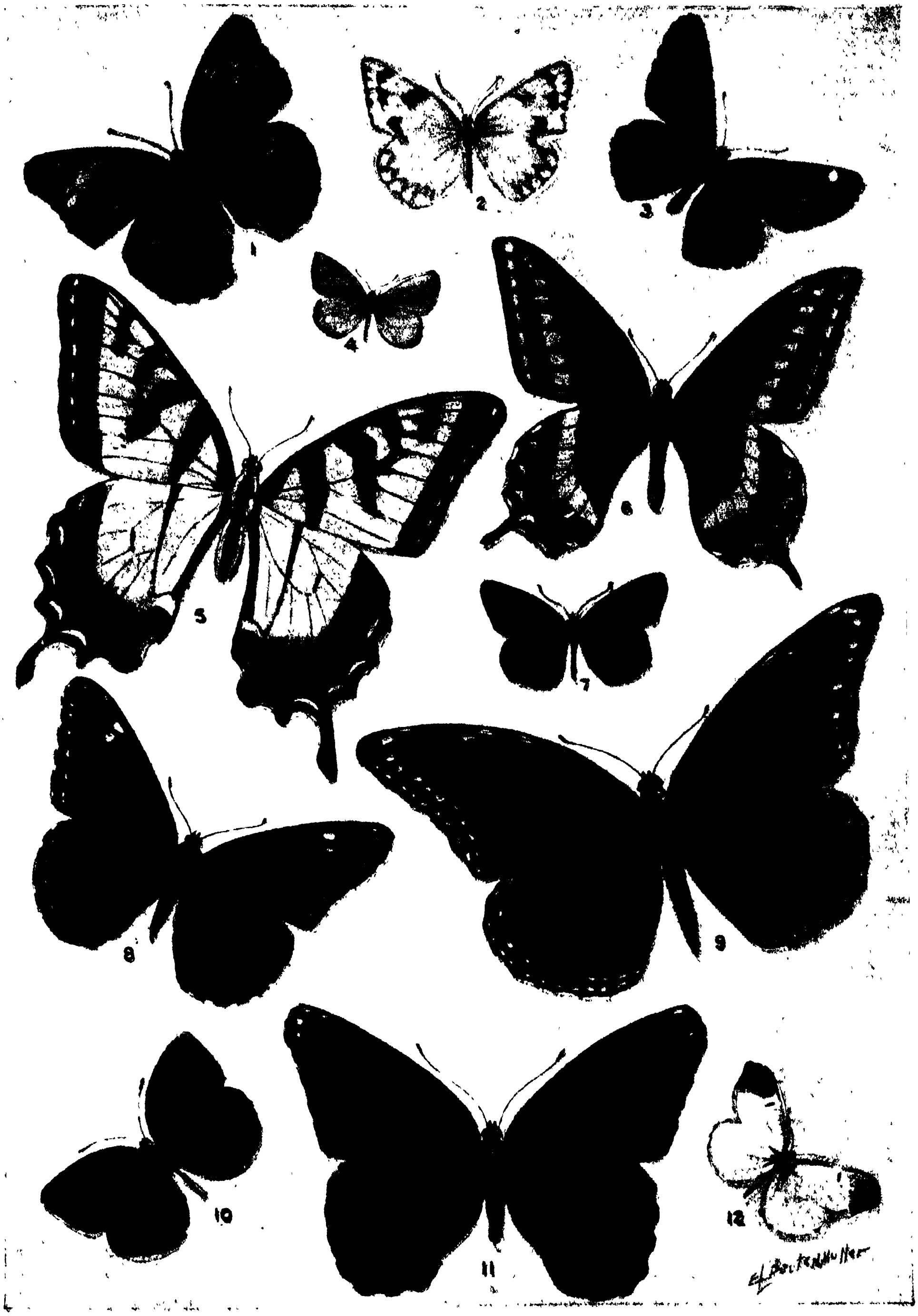
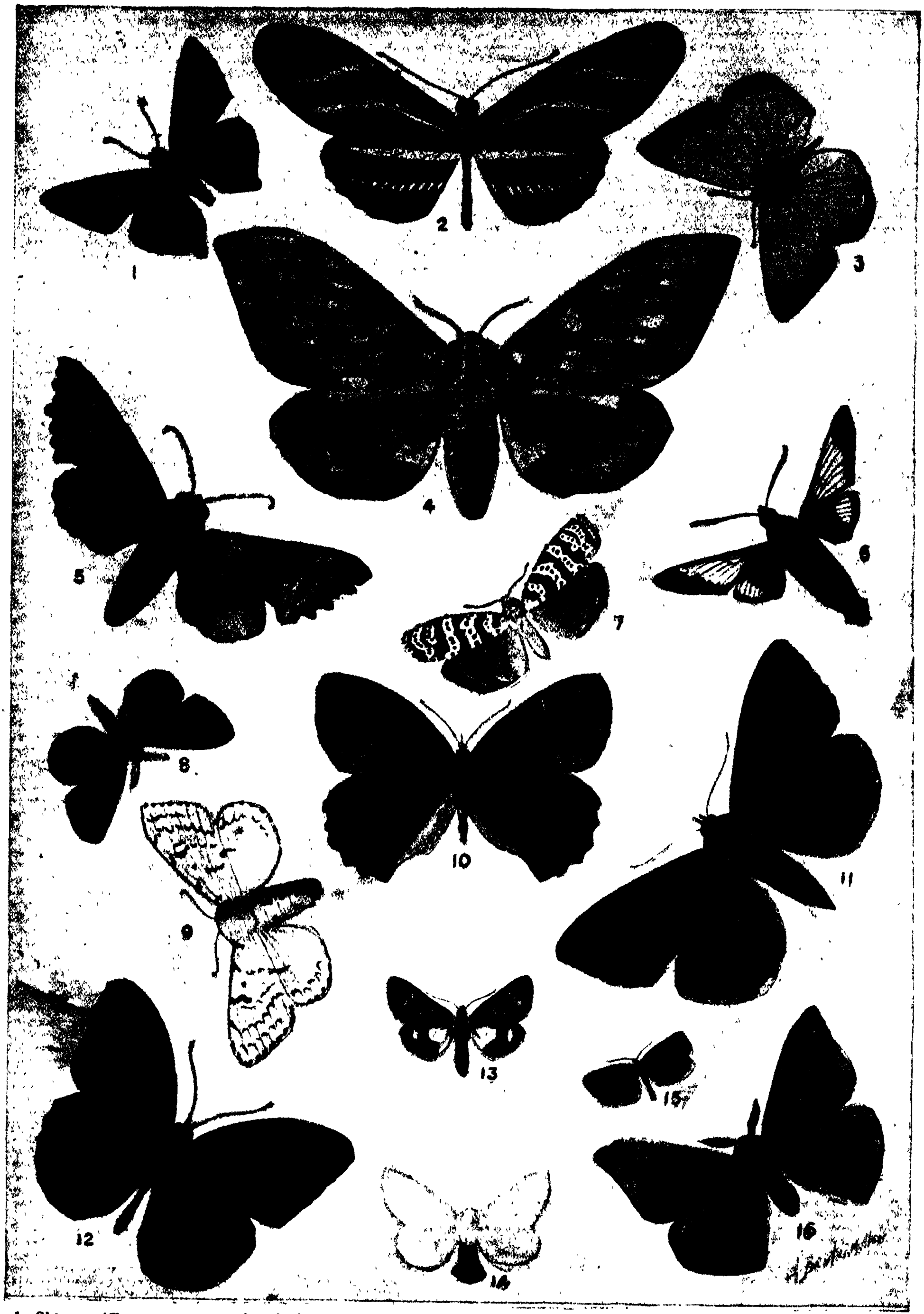
AMERICAN BUTTERFLIES AND MOTHS

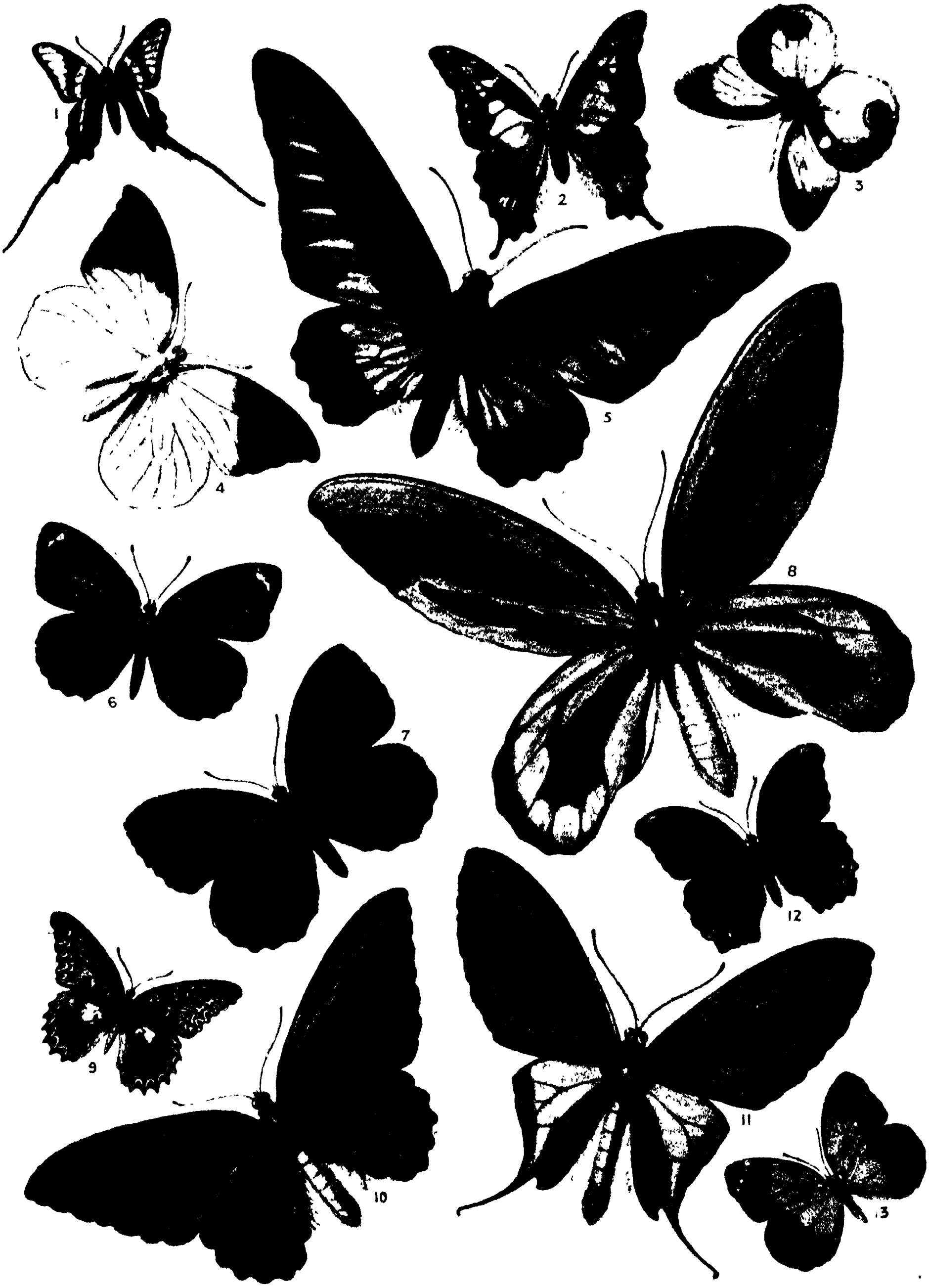


1. Peacock Eye (*Junonia cænia*). 2. Southern Cabbage (*Pieris protodice*). 3. Baltimore (*Melitæa phaeton*). 4. Common Blue (*Lycæna pseudargiolus*). 5. Tiger Swallowtail (*Papilio turnus*). 6. Swallowtail (*Papilio asterias*). 7. Pearl-Crescent (*Phyciodes tharos*). 8. Viceroy (*Basilarchia archippus*). 9. Monarch (*Anosia plexippus*). 10. Orange (*Terias nicippe*). 11. Red-spotted Purple (*Basilarchia astyanax*). 12. Orange Tip (*Euchloe genutia*).



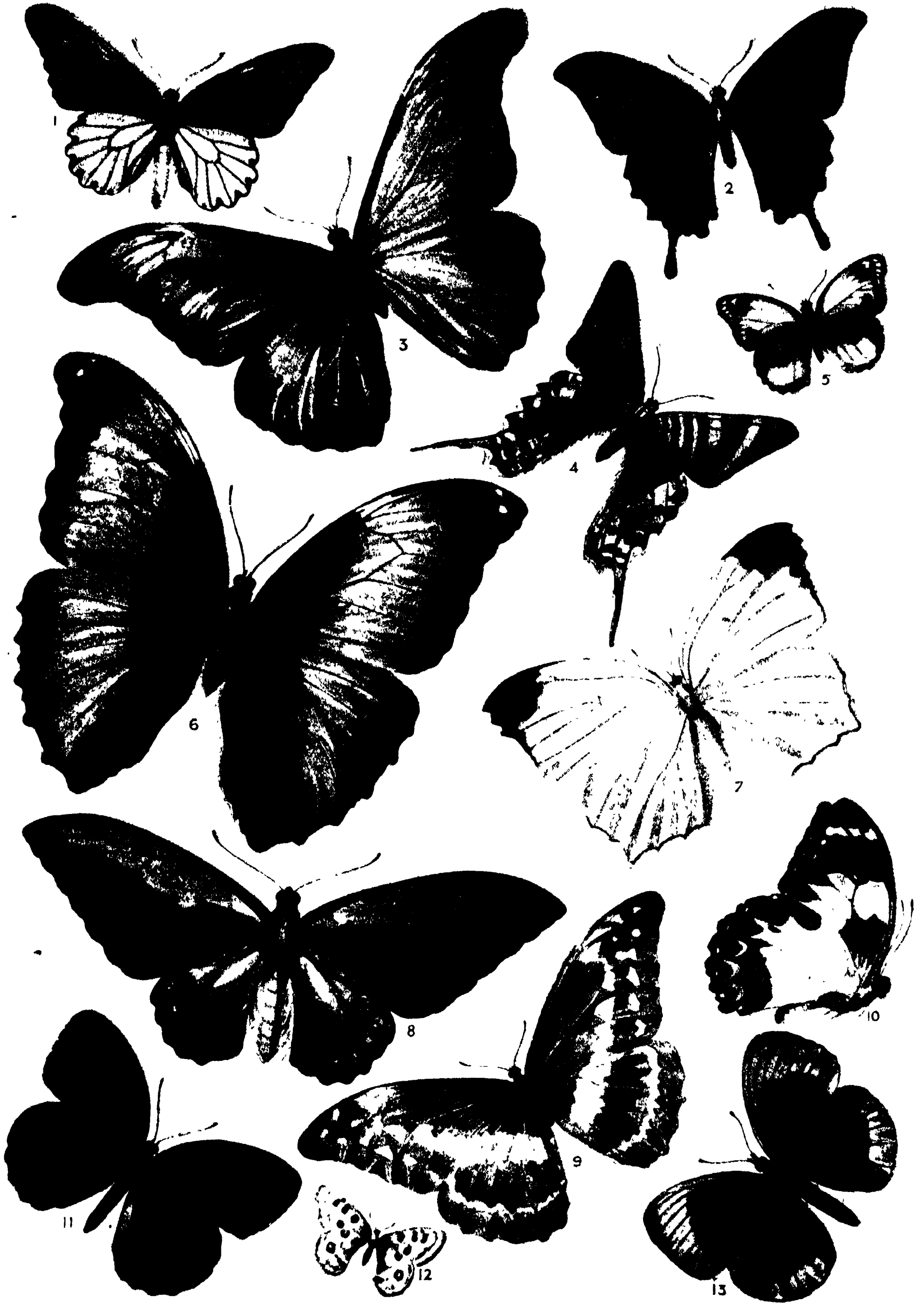
1. Skipper (*Epargyreus tityrus*). 2. Zebra (*Heliconius charithonius*). 3. Common Sulphur (*Colias philodice*). 4. Regal Moth (*Citheronia regalis*). 5. Hawkmoth (*Calasymbolus excæcatus*). 6. Humming-bird Moth (*Hemaris thysbe*). 7. Bella (*Utetheisa bella*). 8. Male Gipsy-moth (*Porthetria dispar*). 9. Female Gipsy-moth (*Porthetria dispar*). 10. Common Wood Nymph (*Satyrus alope*). 11. Red Underwing (*Catocala cara*). 12. Fritillary (*Argynnis cybele*). 13. Grapevine Moth (*Alypia octoma*). 14. Browntail Moth (*Euproctis chrysorrhœa*). 15. Codling Moth (*Carpocapsa pomonella*). 16. Io (*Automeris io*).

BUTTERFLIES, CHIEFLY TROPICAL

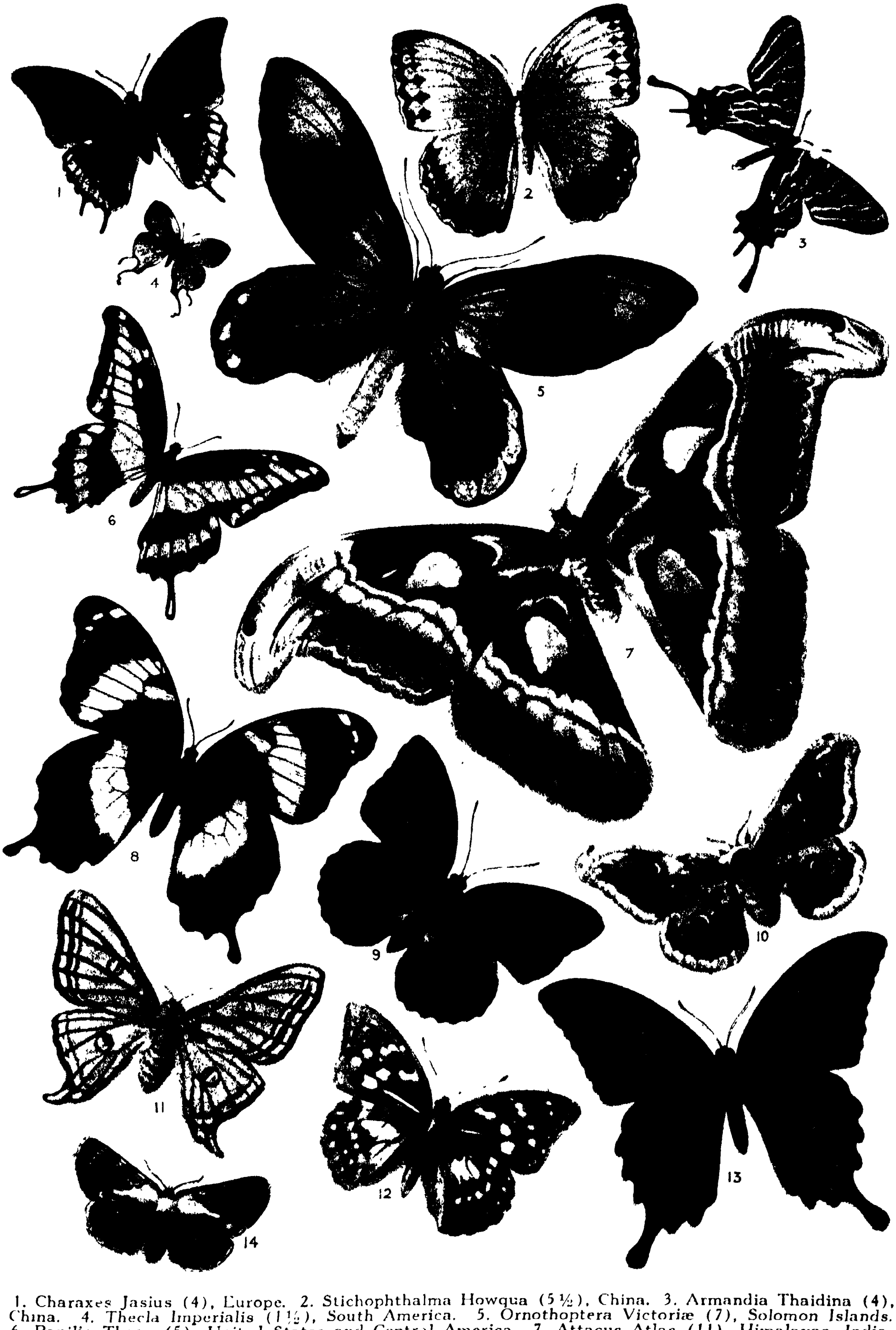


Below are the names and places of the insects above; the figures show the size in inches across the open wings.

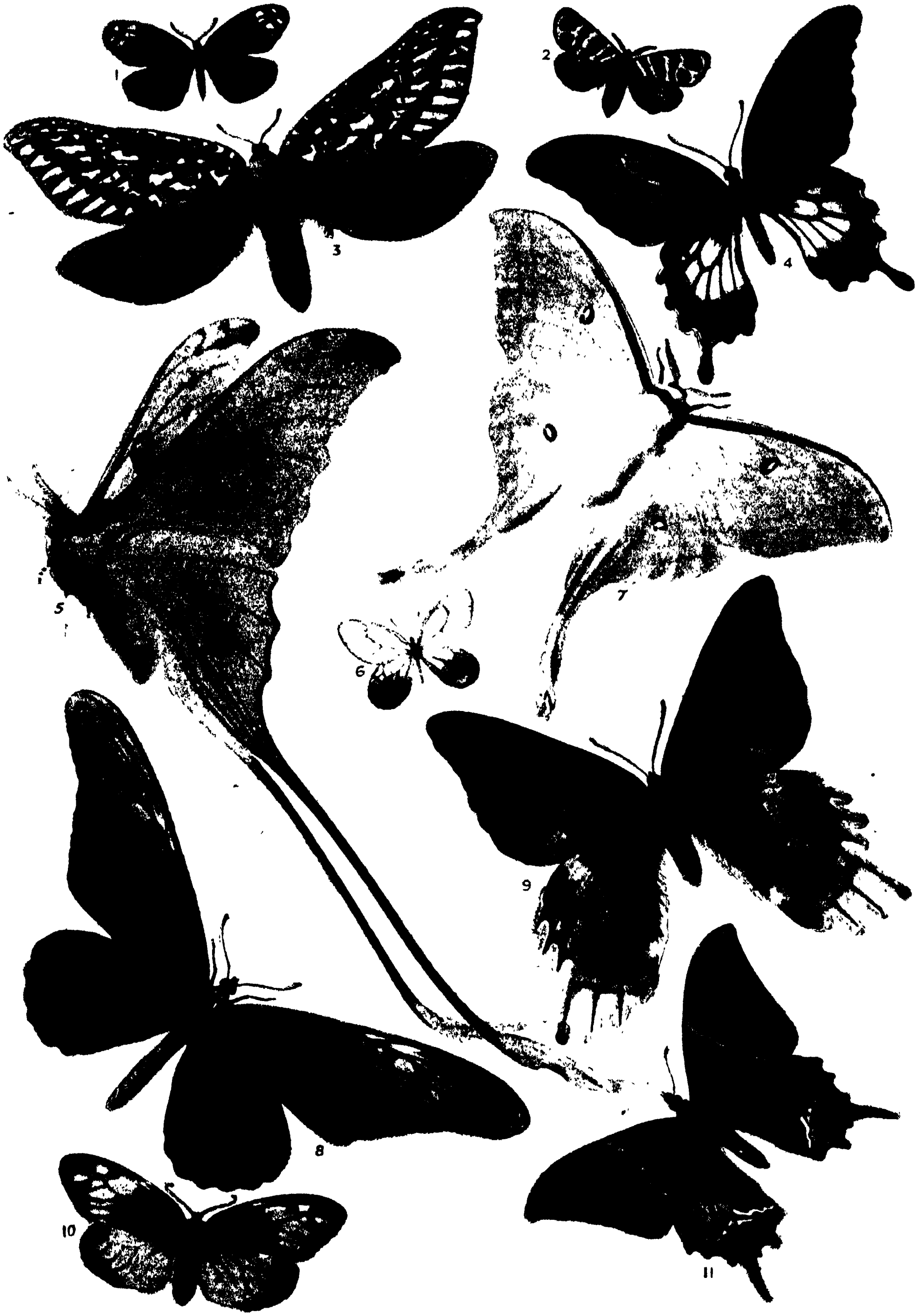
1. Leptocircus Curius (2), Assam. 2 Papilio Weiskei (3½), New Guinea. 3. Tenaris Catops (3½), New Guinea. 4. Hebomoia Celebensis (4½), Celebes. 5 Ornithoptera Brookeana (7), Borneo. 6. Callithea Hewitsoni (2½), Colombia. 7. Catagramma Pitheas (2¼), Colombia. 8. Troides Alexandræ, male (8½), New Guinea, largest of all butterflies, female measuring 10 to 12 inches. 9. Cethosia Myrma (4), Celebes. 10. Ornithoptera Cassandra (6½), North Queensland. 11. Ornithoptera Paradisea (6), New Guinea. 12. Termos Clarissa (3½), New Guinea. 13. Delias Niepelti (2½), New Guinea.



1. Ornithoptera Flavicollis (5½), East Indies 2. Papilio Ulysses (5½), Malay Archipelago. 3. Morpho Rhetenor (5½), Guiana. 4. Urania Sloanus (3), Jamaica. 5. Junonia Orithya (2¼), India. 6. Morpho Deidamia (6), French Guiana. 7. Dercas Gobrias (2¾), Sumatra. 8. Ornithoptera Crœsus (7), Amboina, Moluccas, East Indian Archipelago. 9. Morpho Cypris (5½), Colombia. 10. Papilio Euchenor (5), New Guinea. 11. Catagramma Excelsissima (2½), Peru. 12. Parnassius Apollo (3), Alps, Europe. 13. Callithea Depuiseti (2½), Peru.

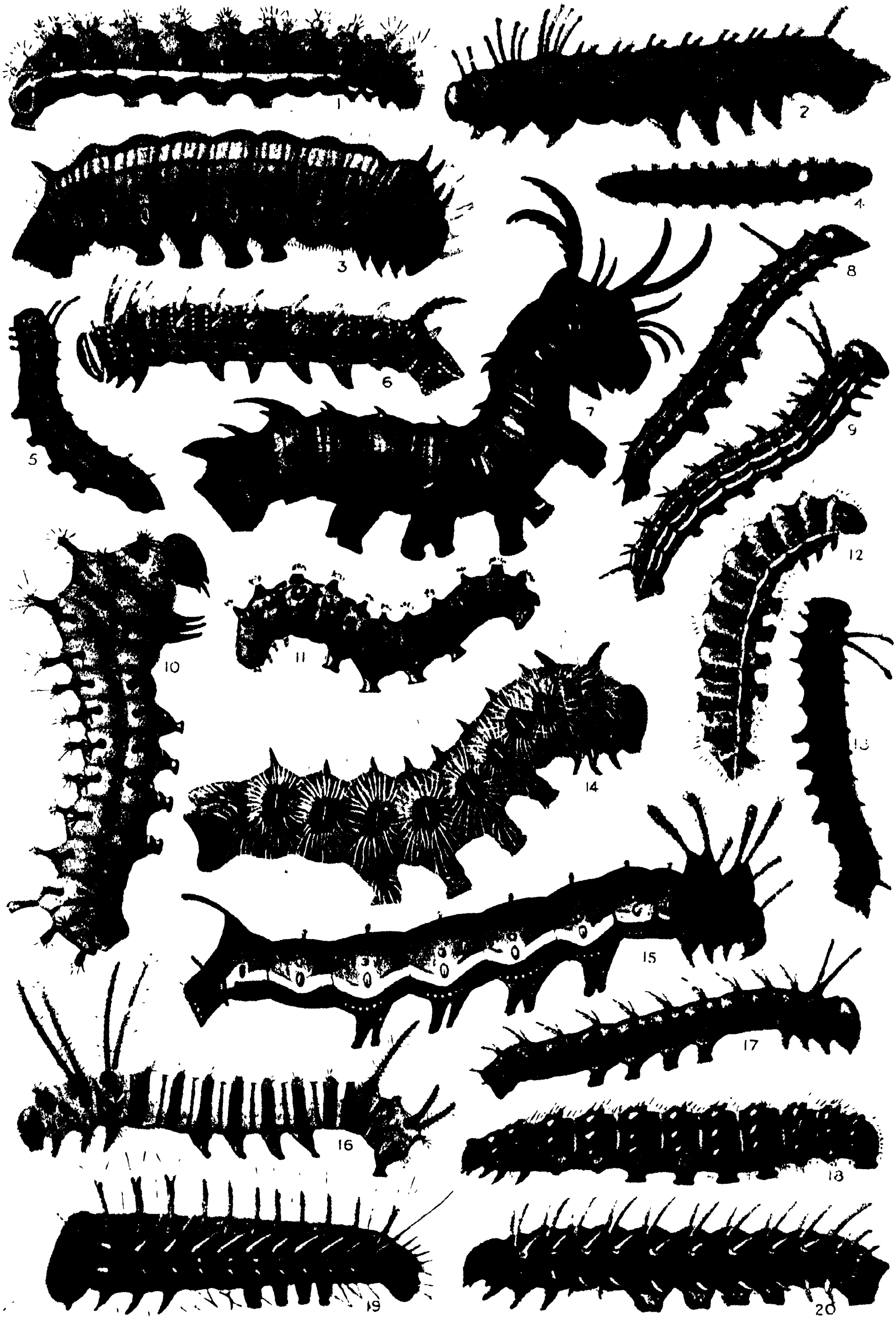


1. Charaxes Jasius (4), Europe. 2. Stichophthalma Howqua (5½), China. 3. Armandia Thaidina (4), China. 4. Thecla Imperialis (1½), South America. 5. Ornothoptera Victoriæ (7), Solomon Islands. 6. Papilio Thoas (5), United States and Central America. 7. Attacus Atlas (11), Himalayas, India. 8. Papilio Homerus (6), Trinidad. 9. Agrias Lugens (4), Peru. 10. Saturnia Pyri (5¼), Southern France. 11. Grællsia Isabellæ (4), Spain. 12. Euripus Charonda (4½), Japan. 13. Papilio Blumei (5½), Celebes. 14. Agarista Agricola (3), Brisbane.

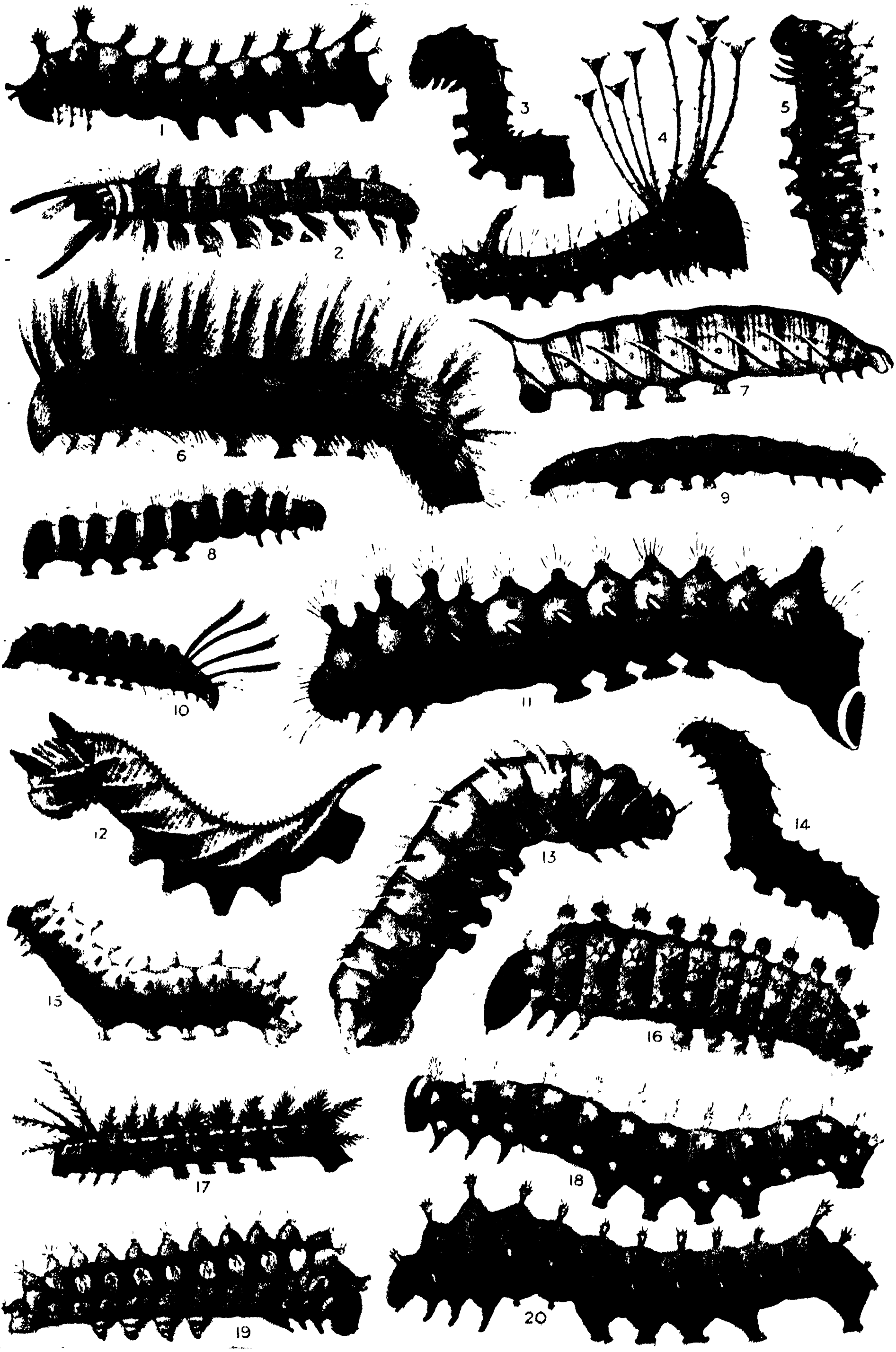


1. Campylotes Histrionicus (3), Northern India. 2. Arctia Hebe (2), Europe. 3. Leto Venus (6), South Africa. 4. Papilio Memnon (6), Assam. 5. Argema Mittrei (9½ inches long, 8 inches across; the most wonderful moth in the world), Madagascar. 6. Citherias Menander, or Clearwing Aurora (2½), Colombia. 7. Actias Selene, or Moon Moth (6), Assam. 8. Papilio Antimachus (8½), Stanley Pool, Congo. 9. Urania Riphœus (4½), Madagascar. 10. Erasmia Pulchella (4), Assam. 11. Teinopalpus Imperialis (3½), Darjeeling, India.

SOME STRANGE CATERPILLARS



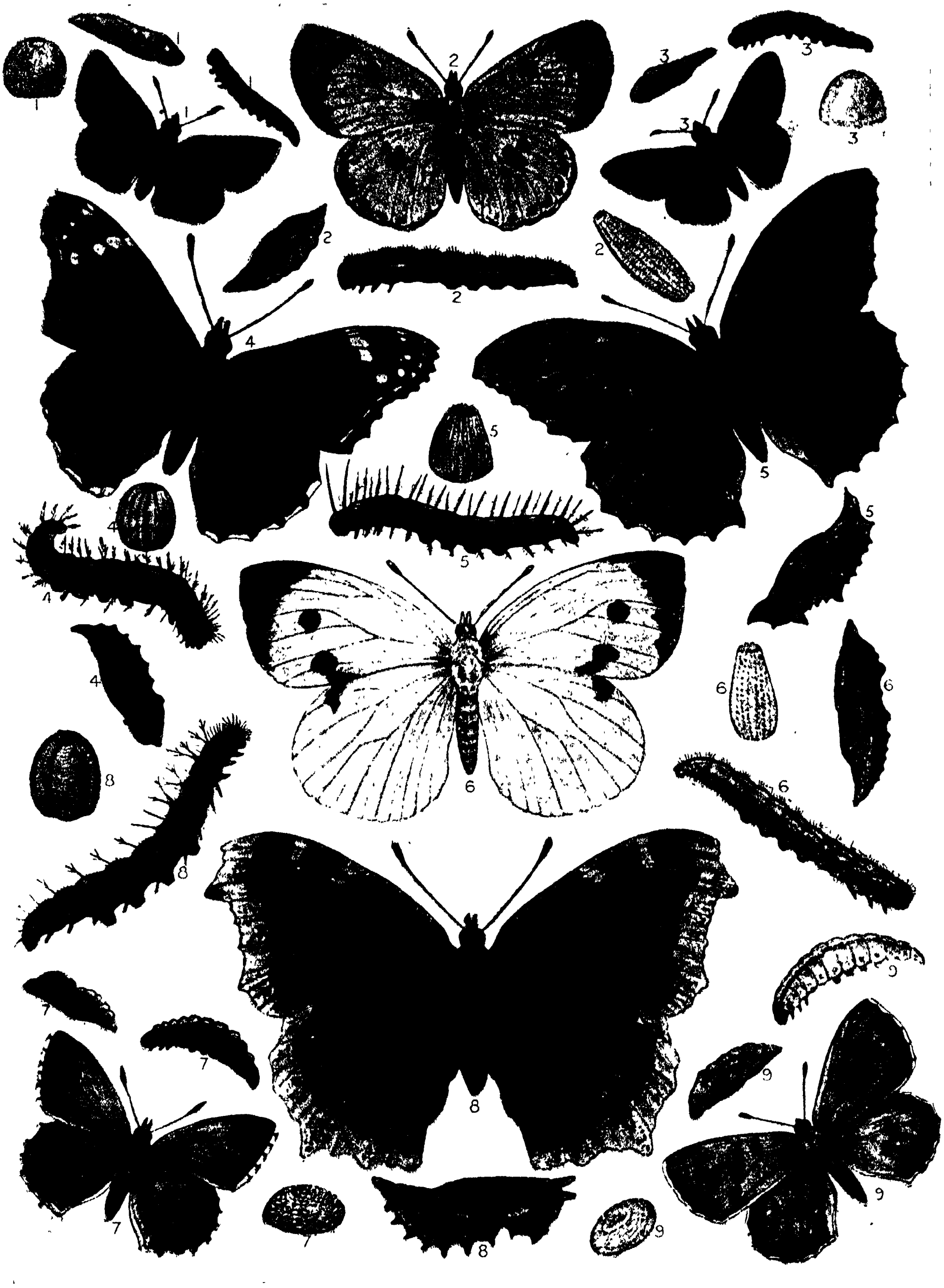
1. Pear-tree Silk-moth (*Saturnia pyri*), India. 2. Laocoon Walnut Moth (*Citheronia laocoon*), Brazil. 3. Eacles Cacicus, Brazil. 4. Cricula Trifenestrata, Himalayas. 5. Rosy Maple Moth (*Anisota rubicunda*), United States. 6. Honey-locust Moth (*Adelocephala isias*), Texas. 7. Citheronia regalis, Brazil 8. Anisota Virginiensis, United States. 9. Anisota Consularis, United States. 10. Ceanothus Silk-moth (*Samia rubra*), California. 11. Eupackardia Calleta, Mexico. 12 Urota Sinope, Natal. 13. Anisota Senatoria, United States. 14 Eacles Imperialis, United States 15. Hooked Citheronia (*Citheronia phoronea*), South America. 16 Brahmea Japonica, Japan. 17. Anisota Stigma, United States. 18. Loepa Katinka, Sumatra. 19. Buck Moth (*Hemileuca maia*), United States. 20. Bunæa Caffra, South Africa.



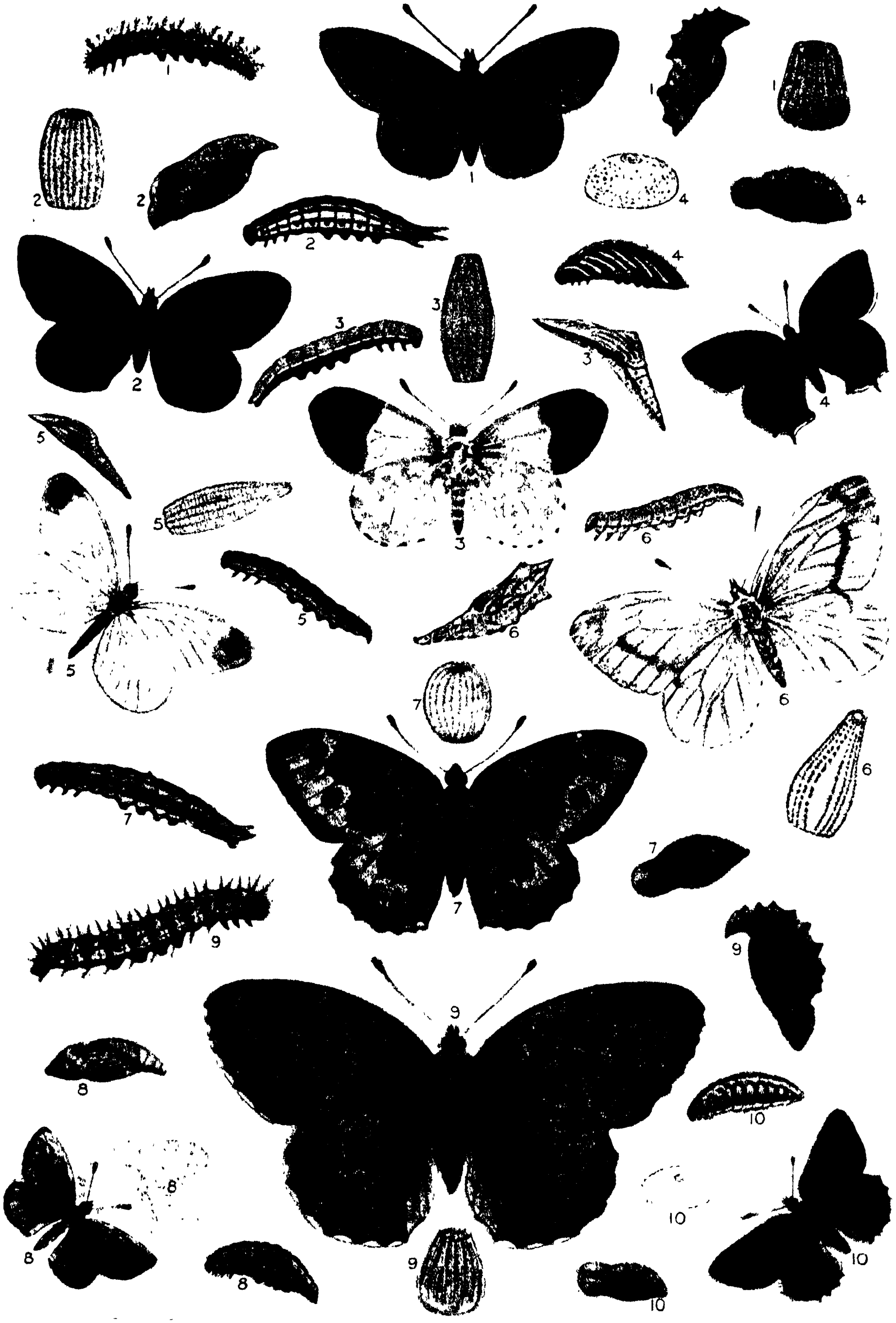
1. Samia Gloveri, Rocky Mountains. 2. Vishnu Moth (*Trabala vishnu*), India. 3. Nudaurelia Cytheria, South Africa. 4. Sysphinx Molina, Central America. 5. Orizaba Silk-moth (*Rothschildia orizaba*), Mexico. 6. Gonometer Robusta, Rhodesia 7. Chæocampa Celeris, India. 8. Eusemia Bisma, India. 9. Anticyra Combusta, India. 10. Phalanna Polymena, India. 11. Moon Silk-moth (*Actias selene*), India. 12. Four-horned Sphinx (*Ceratonia amyntor*), United States. 13. Atlas Silk-moth (*Attacus atlas*), India. 14. Thyella Tyrrhæa, South Africa. 15. Phylosamia Cynthia, China. 16. Telea Polyphemus, United States. 17. Automeris Pamina, United States. 18. Coloradia Venata, Argentina. 19. Jorulla Silk-moth (*Rothschildia jorulla*), Mexico. 20. Columbian Silk-moth (*Samia columbia*), United States

BUTTERFLIES, CHIEFLY EUROPEAN

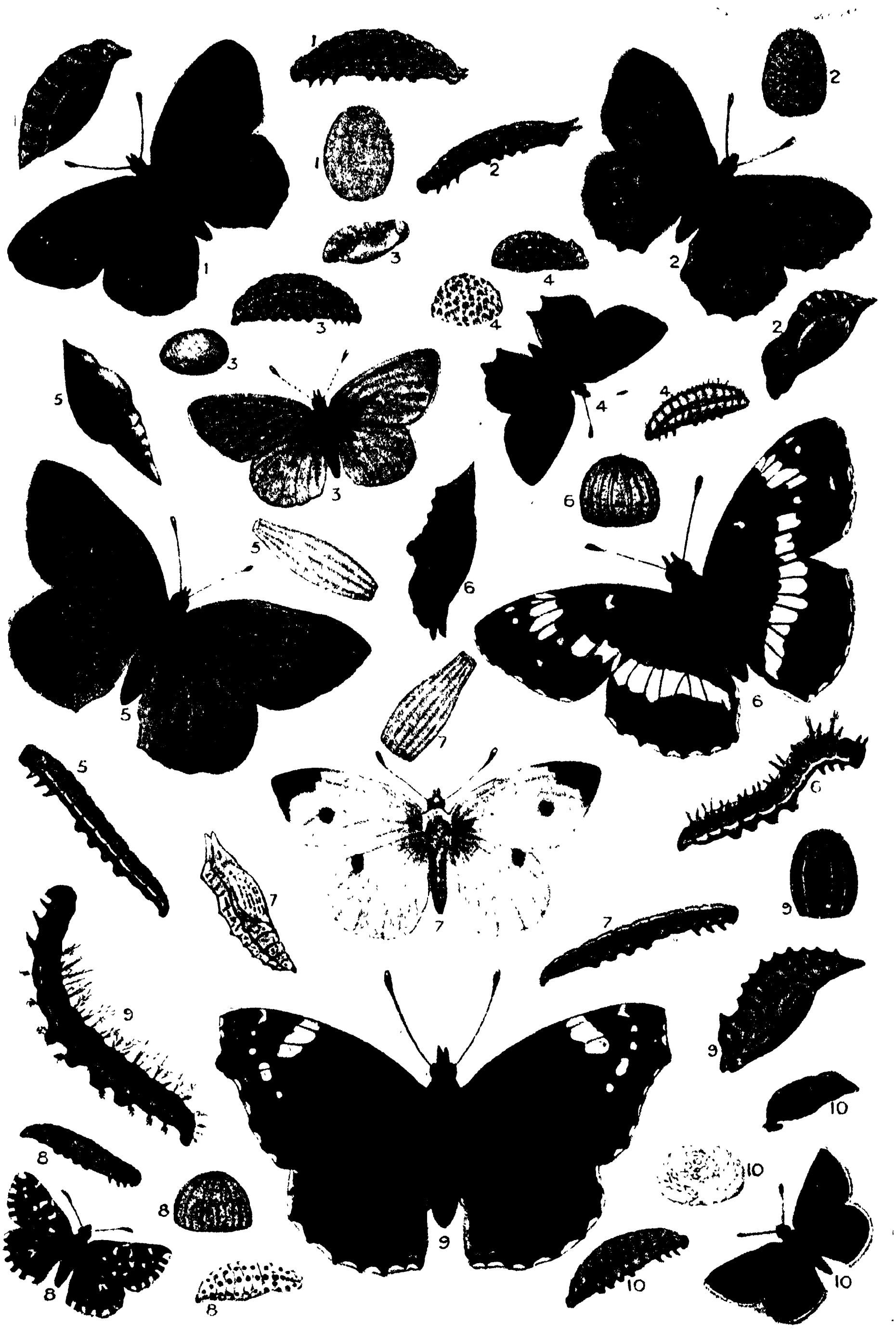
The butterflies and moths in the pages following are principally European, though a few of them are also found in America, as you have learned in the text. In many other cases we have a butterfly closely resembling the one shown on these pages, though it may not be absolutely identical.



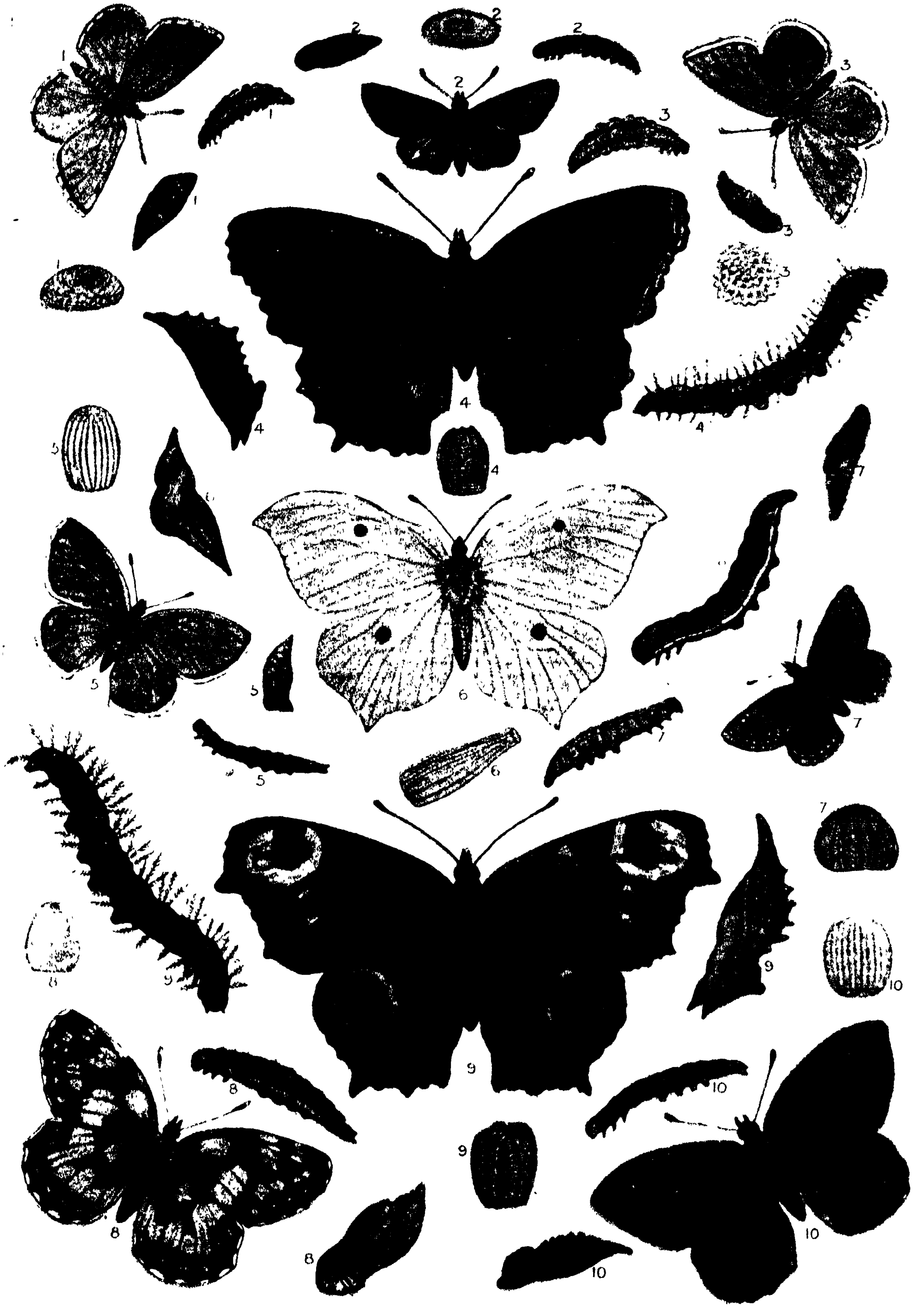
1. Large Skipper (*Augiades sylvanus*). 2. Pale Clouded Yellow (*Colias hyale*). 3. Silver-spotted Skipper (*Augiades comma*). 4. Painted Lady (*Pyrameis cardui*). 5. Silver-washed Fritillary (*Argynnis paphia*). 6. Large White (*Pieris brassicæ*). 7. Chalk Hill Blue (*Lycæna Corydon*). 8. Camberwell Beauty (*Vanessa antiopa*). 9. Large Blue (*Nomiades arion*).



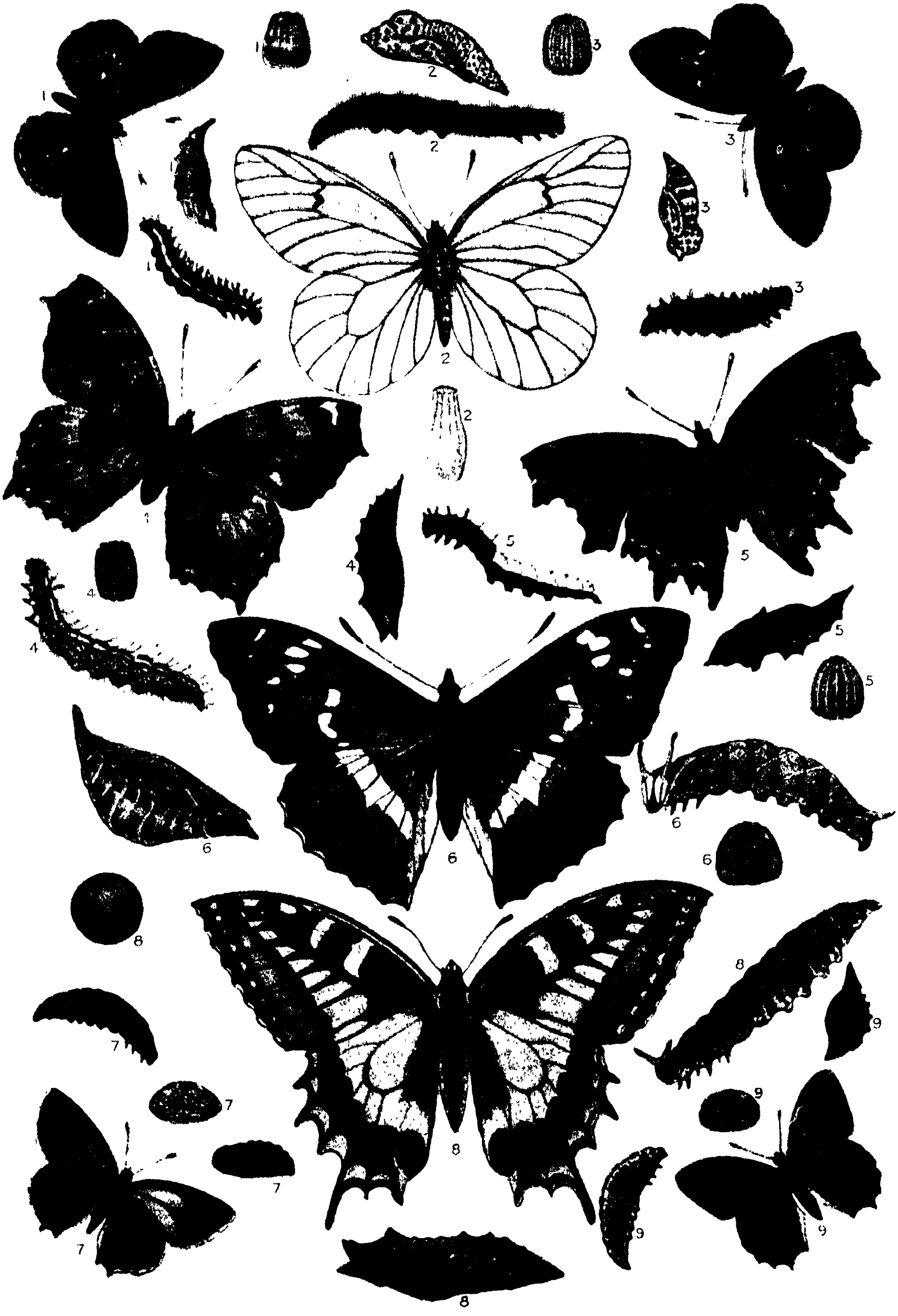
1. Pearl-bordered Fritillary (*Argynnis euphrosyne*). 2. Mountain Ringlet (*Erebia epiphron*). 3. Orange Tip (*Euchloe cardamines*). 4. White-letter Hairstreak (*Thecla W-album*). 5. Wood White (*Leucophasia sinapis*). 6. Green-veined White (*Pieris napi*). 7. Grayling (*Satyrus semele*). 8. Silver-studded Blue (*Lycæna ægon*). 9. Dark Green Fritillary (*Argynnis aglaia*). 10. Green Hairstreak (*Thecla rubi*).



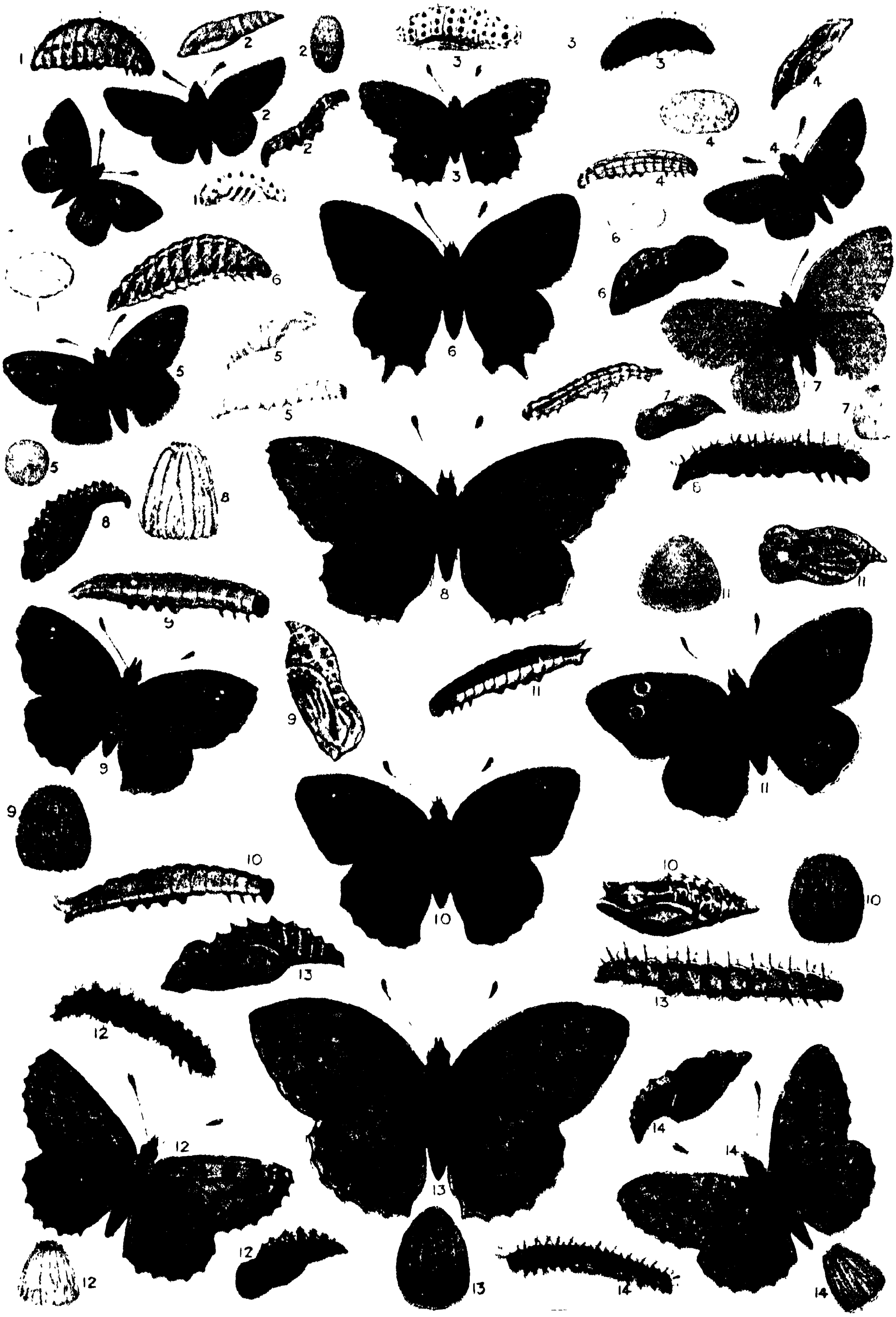
1. Northern Brown, or Scotch, Argus (*Erebia blandina*). 2. Speckled Wood (*Pararge egeria*). 3. Azure, or Holly, Blue (*Cyaniris argiolus*). 4. Small Copper (*Chrysophanus phlœas*). 5. Clouded Yellow (*Colias edusa*). 6. White Admiral (*Limenitis sibylla*). 7. Small White (*Pieris rapæ*). 8. Grizzled Skipper (*Hesperia malvæ*). 9. Red Admiral (*Pyrameis atalanta*). 10. Brown Argus (*Lycæna astrarche*).



1. Clifden, or Adonis, Blue (*Lycæna bellargus*). 2. Small Skipper (*Adopæa thaumas*). 3. Common Blue (*Lycæna icarus*). 4. Large Tortoiseshell (*Vanessa polychloros*). 5. Small Heath (*Cænonympha pamphilus*). 6. Brimstone (*Gonepteryx rhamni*). 7. Dingy Skipper (*Thanaos tages*). 8. Marbled White (*Melanargia galatea*). 9. Peacock (*Vanessa io*). 10. Wall (*Pararge megæra*).

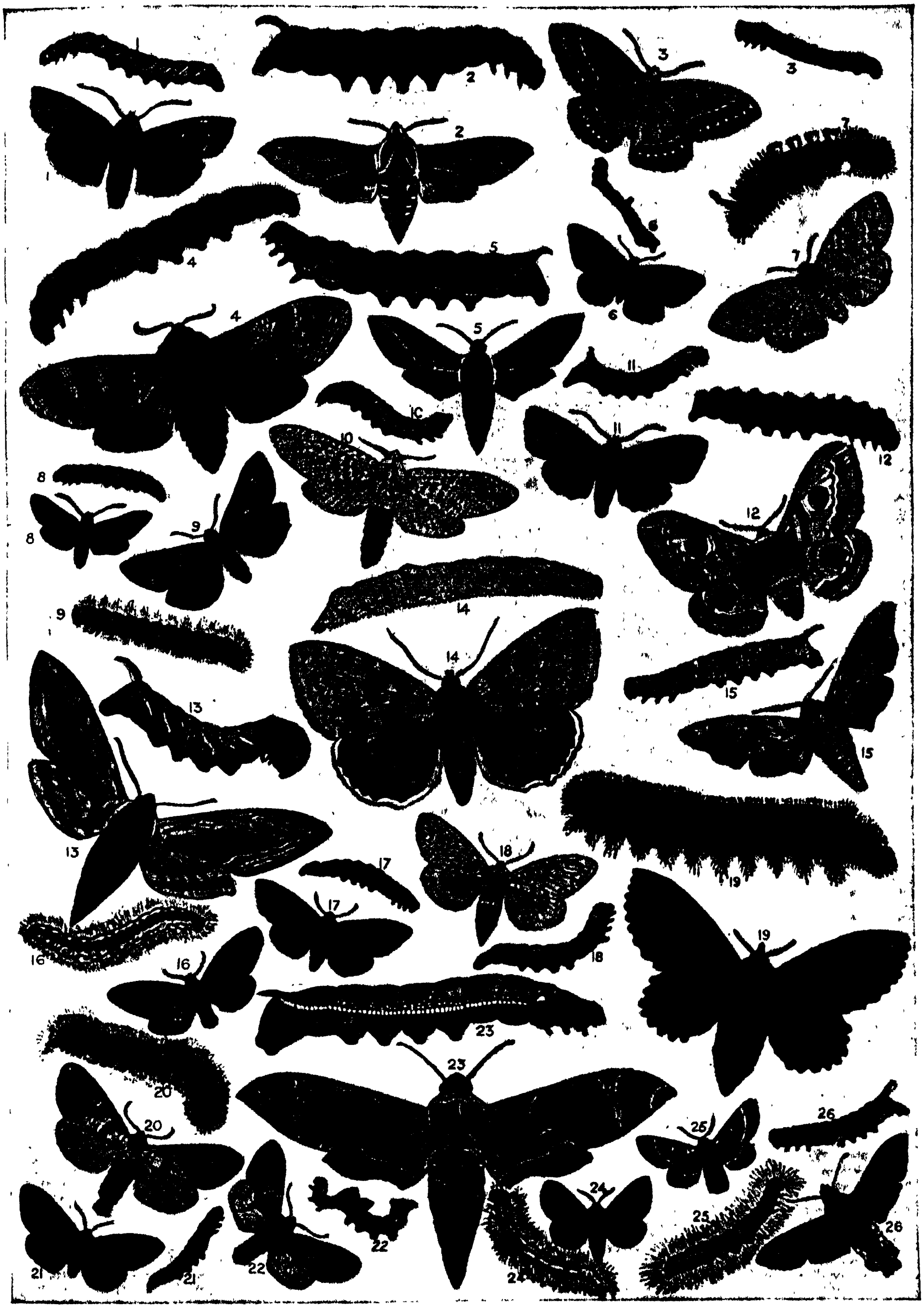


1. Greasy, or Marsh, Fritillary (*Melitæa aurinia*). 2. Black-veined White (*Aporia cratægi*). 3. Heath Fritillary (*Melitæa athalia*). 4. Small Tortoiseshell (*Vanessa urticæ*). 5. Comma (*Polygonia C-album*). 6. Purple Emperor (*Apatura iris*). 7. Purple Hairstreak (*Zephyrus quercus*). 8. Swallowtail (*Papilio machaon*). 9. Black Hairstreak (*Thecla pruni*).



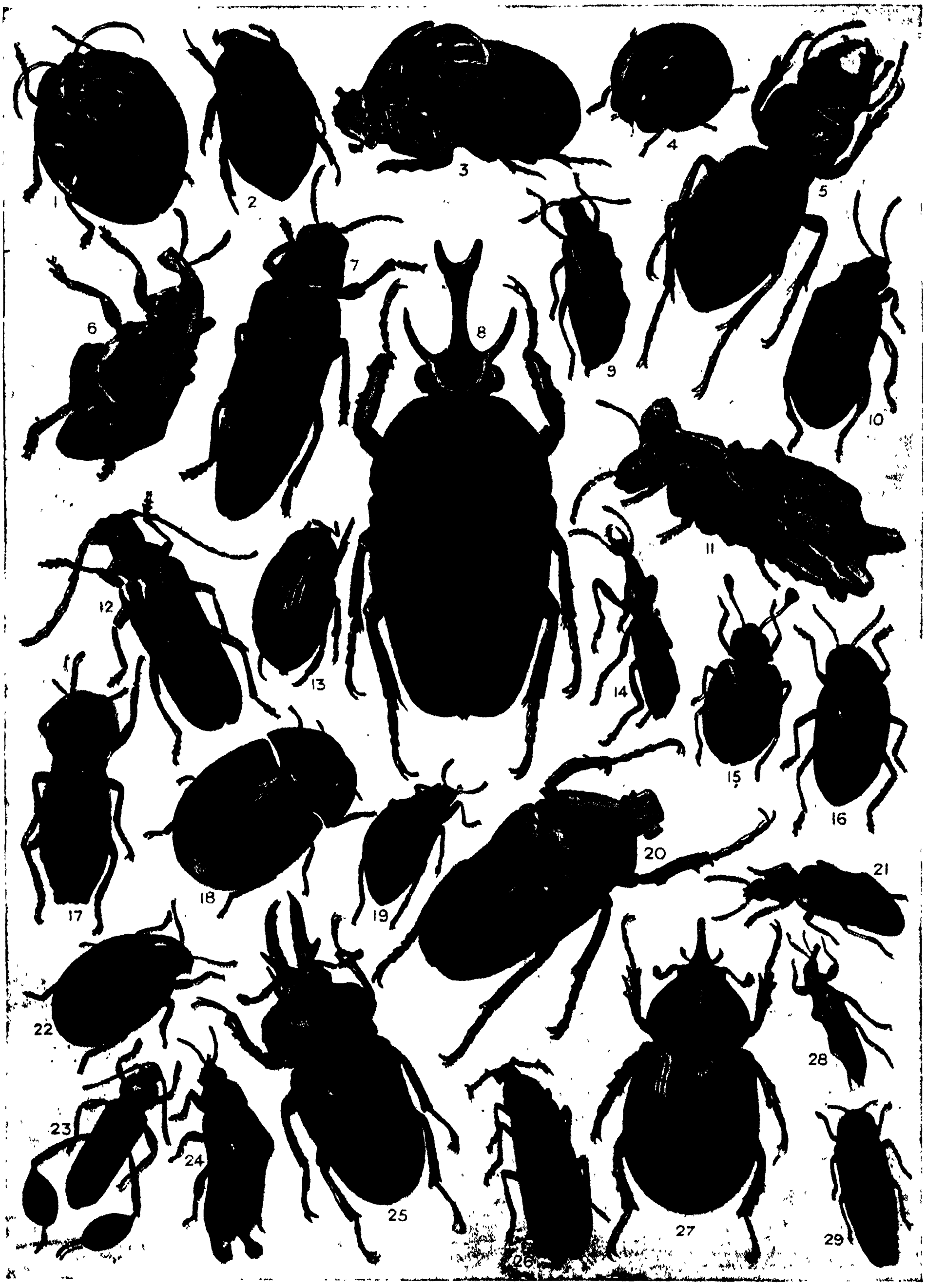
1. Small, or Bedford, Blue (*Zizera minima*) 2. Essex Skipper (*Adopæa lineola*). 3. Duke of Burgundy Fritillary (*Nemeobius lucina*). 4. Lulworth Skipper (*Adopæa actæon*). 5. Checkered Skipper (*Carterocephalus palæmon*). 6. Brown Hairstreak (*Zephyrus betulæ*). 7. Large Heath, or Marsh, Ringlet (*Cænonympha typhon*). 8 Queen of Spain Fritillary (*Argynnis lathonia*). 9. Small Meadow Brown, or Gatekeeper (*Epinephele tithonus*). 10. Meadow Brown (*Epinephele janira*). 11. Ringlet (*Aphantopus hyperanthus*). 12. Glanville Fritillary (*Melitæa cinxia*). 13. High Brown Fritillary (*Argynnis adippe*). 14. Small Pearl-bordered Fritillary (*Argynnis selene*).

EUROPEAN MOTHS AND CATERPILLARS



1. Broad-bordered Yellow Underwing. 2. Spurge Hawk. 3. Large Emerald. 4. Goat. 5. Elephant Hawk. 6. Brimstone. 7. Pale Tussock. 8. Six-spotted Burnet. 9. Scarlet Tiger. 10. Leopard. 11. Copper Underwing. 12. Emperor. 13. Privet Hawk. 14. Clifden Nonpareil. 15. Lime Hawk. 16. December. 17. Peach Blossom. 18. Black Arches. 19. Lappet. 20. Buff-tip. 21. Cinnabar. 22. Pebble Prominent. 23. Oleander Hawk. 24. Lackey. 25. Small Eggar. 26. Humming-bird Hawk.

SOME EXTRAORDINARY BEETLES



1. Splendid dolichotoma. 2. Macropopillia beetle. 3. Emperor phanocus. 4. Great synonycha ladybird. 5. Bates monhotia. 6. Bennett's cupholus. 7. Violet golden-surface beetle. 8. Peratorrhina beetle. 9. Blue-and-yellow hare bettle. 10. Fourteen-spot podontia. 11. Solid heart-shaped sepidium. 12. Dorcasomus beetle. 13. Four-spot paratasia. 14. Marked arrhenodes. 15. Beautiful horned euchteanus. 16. Five-spot scaphidomorphus. 17. Jourdan's lapherus. 18. Pierced olive beetle. 19. Variegated darling beetle. 20. Rucker's jumnos. 21. Graceful lia beetle. 22. Ribboned proseisceia. 23. Precious leaf-footed beetle. 24. Single-horned xenarescus. 25. Muller's phalacrognathus. 26. Beautiful eupyrochroa. 27. Powerful tityus beetle. 28. Wallace's belus weevil. 29. Great agrilus.

DOLLS OF FOREIGN LANDS

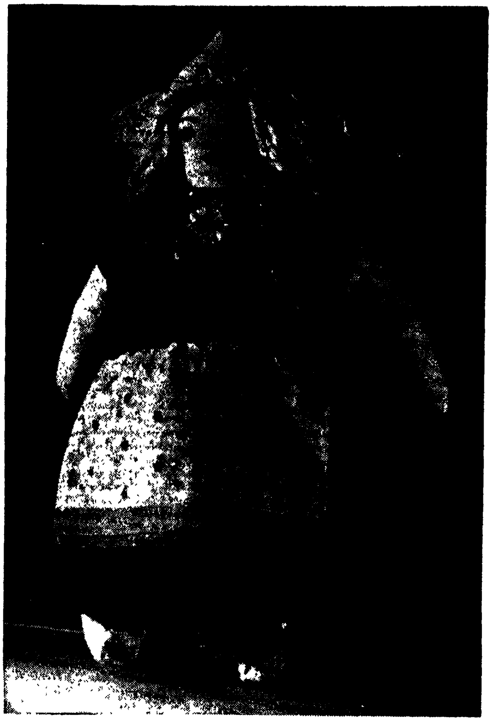
THERE is no better way to learn about the costumes of other lands than to collect foreign dolls in native dress. Of course, doll-collectors who can travel in many countries are particularly fortunate. On their wanderings they can cater to their hobby and come back with armsful of dolls that would delight any little girl: flaxen-haired Swedish dolls; wooden-shoed Dutch dolls; gay, chic French dolls; dolls of Haiti with colorful bandanas; dolls of India in the flowing garments known as saris.

Luckily it is not necessary for us to travel in order to collect foreign dolls, for we can make them ourselves. A little reading about foreign costumes, a few scraps of material, some simple directions—that is all we need to start our own collection. It is fun to make a simple doll and then to dress it in the chosen costume. It is an easy way, too, to learn something of the people who live in other lands.

We shall begin with a collection of seven little rag dolls, representing seven different peoples. Rag dolls are the easiest of all to make, and they are the least expensive. If your mother sews, she undoubtedly has some bright remnants of material that she will be glad to let you have. You can make the dolls' bodies as well as their clothing from these scraps. A practical length for such a home-made doll is ten inches; anything smaller than that is rather hard to handle. The stitching can be done by hand, of course, but it will be firmer if you can use a sewing machine.

All the dolls' bodies are made alike. Patterns for the arms, legs, head and trunk are shown in figures 1, 2 and 3. Draw these patterns (and the others shown, as well) on light-weight paper, such as tracing paper, to the dimensions given. Fabric for the body pieces should be closely woven and pale pink or cream color. However, for a Chinese doll it should be lemon-yellow; and for an Indian doll, light brown. Hair may be wool, cotton floss, crepe paper or heavy mercerized thread.

Always look to see whether a fabric has a right and a wrong side. Plain materials may be the same on both sides; but usually the colors are brighter on one side of figured materials. The brighter side is the right side. Be sure to cut the pieces and sew them together so that the right side will show in the finished work. Seams are sewed together with the right sides facing (as you sew, you are looking at one of the wrong sides). When the joined piece is turned right side out, the raw edges will be hidden.



The Dutch doll, which represents the land of tulips.

On the straight of the goods, fold the material for the body so that you have a double thickness. Place the tracing-paper patterns for the body on this double thickness, making sure that the top of the head-and-trunk piece is on the fold, as marked in figure 3. Pin the patterns firmly, then cut around them. Take the arm and leg patterns, pin them on more of the double thickness, and cut. You now have four arm and four leg pieces, because each of the doll's two arms and two legs requires two pieces. You also have a single piece, which is the front and back of the trunk and head, joined together at the top of the head.

Place two matching arm pieces together, with right sides facing. Sew together along

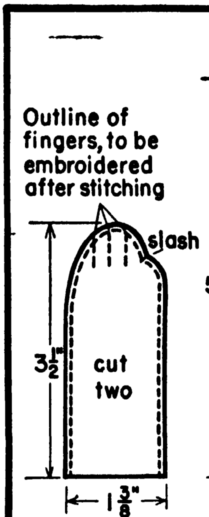


Fig. 1. Arm

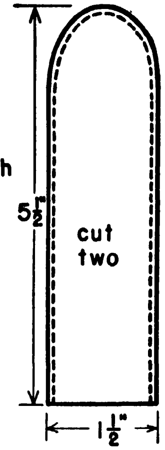


Fig. 2. Leg

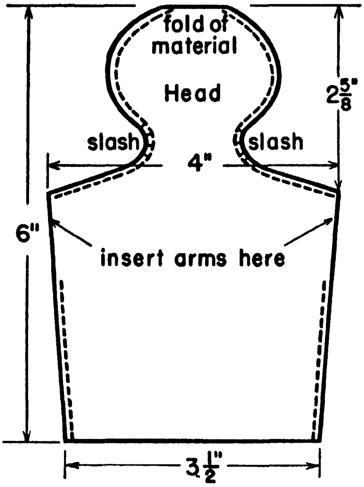


Fig. 3. Trunk

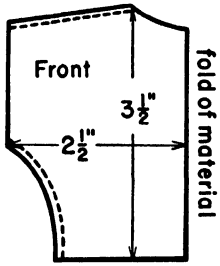


Fig. 4. Blouse

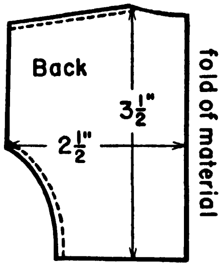


Fig. 5. Blouse

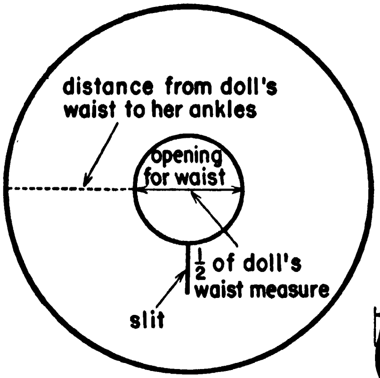

distance from doll's waist to her ankles
opening for waist
½ of doll's waist measure
slit

Fig. 6. Skirt

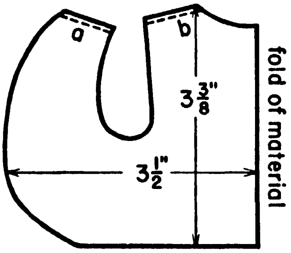


Fig. 7. Bolero

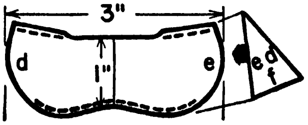


Fig. 8. Shoe

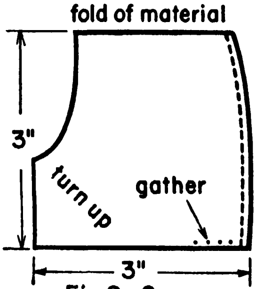


Fig. 9. Cap

the dotted lines, as shown in figure 1, leaving the top of the arm open. Make two or three small cuts, from the edge of the material up close to the stitching, at the curved part marked "slash." This will keep the material from puckering when the arm is turned right side out. Turn the arm right side out, and embroider the fingers, in chain stitch, as shown in figure 1. Then stuff the arm with cotton batting, kapok, sawdust or bits of rags to about ¼" from the open end. Make the other arm and the two legs in the same way.

Match back and front of the head-and-trunk piece, keeping the fold at the top as when it was cut and making sure that right sides are facing. Sew together along the dotted lines as shown in figure 3, leaving the bottom and arm holes open. Slash the curved part of the seams as marked.

Push an arm through one of the arm holes until the arm is completely inside the trunk and the raw edges of the open end of the arm and the arm hole are together. Watch that the seam of the arm nearest to which the thumb is embroidered matches the under-arm seam of the trunk. Then sew the edges of arm and arm hole together. Attach the other arm in the same way. Now turn the head-and-trunk piece inside out—this will bring the arms outside too. Stuff the head and trunk of the doll. Insert the tops of the legs at the proper places, turn in the raw edge of the trunk and sew across the whole bottom of the trunk, catching in the tops of the legs. This will also keep the stuffing from falling out.

Sketch the features lightly and color them with crayon, or embroider them.

THE DUTCH DOLL

Her hair is made of yellow strands of wool, sewed to the top of her head.

The pattern for her blouse is shown in figures 4 and 5. Each piece is one-half of the blouse, so the material must be folded, on the straight of the goods, and the patterns placed so that the side marked "fold" is on the fold of the fabric. Pin and cut. You now have a whole front and a whole back. Match shoulders of front to shoulders of back, and sides of front to sides of back, with right sides facing. Sew along shoulders and sides as indicated by the dotted lines. Then turn the blouse right side out. Hem the neck and sleeve edges. To get it over the doll's head, slit the front down the middle from the neck, all or part of the way. After it is on the doll, turn one edge of the slit under and sew it in place over the other edge. A piece of embroidery may be sewed over the front of the blouse as in the photograph.

Figure 7 is the pattern for the bolero. Lay the pattern on folded material as indicated. After it is cut out, match each of the front shoulders, marked *a*, to the corresponding back shoulders, marked *b;* and sew along the dotted lines. Turn the bolero right side out. Turn under, about ⅛", the edges of the arm holes and the back of the neck, and hem. The front and bottom edges also may be hemmed, or you can finish them with narrow lace, rickrack or binding.

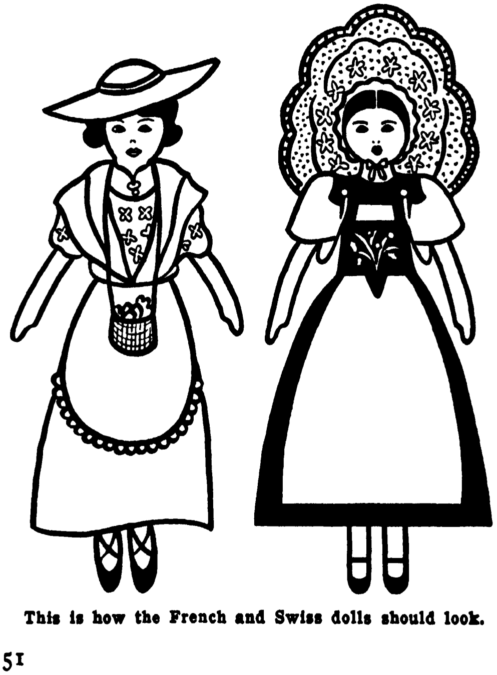
The doll has at least two petticoats, a skirt and an apron. Figure 6 shows the pattern for the petticoats and the skirt. Cut out only one thickness of material for each piece. The circle in the center is the waist, and the slit from it is so that you can get these pieces on the doll. Put the bottom petticoat on the doll; gather it at the waist with strong thread. Slip on the second petticoat and gather it. Finally, put on the skirt and gather it. Hem the edges of the skirt and the petticoats.

As you can see from the photograph, the apron is of thin white flowered material, banded in darker, plain colors at top and bottom.

The finished apron should be just a little shorter than the skirt; and the apron should be wide enough so that it can be gathered to the sash at the top. Cut a piece of flowered material to the right proportions. The bands at top and bottom and the sash can be made most easily from ribbon, in colors to match the flowers. Sew the strips together very near the edges so that they will lie flat; and hem the sides. For the apron sash, cut a piece of ribbon long enough to tie in a bow in the back. Then gather the top of the apron and sew it to the front of the sash. Tie the apron on the doll.

The cap pattern is shown in figure 9. Place it on folded material as indicated. Pin, cut, and sew along the dotted line. This seam is the center back. Gather at the place indicated. Sew lace to the front edges of the cap, and put it on the doll as shown in the photograph.

Figure 8 shows the two pieces necessary to make a single shoe. Cut them from yellow felt or some similar heavy material. Fold the large piece along the heavy line in the center. The triangular piece is the front of the shoe. Match side *d* with side *D,* side *e* and side *E.* Sew the two pieces together on either side; then tuck side *f* into the bottom



This is how the French and Swiss dolls should look.

of the shoe. Sew the bottom from the fold up to the base of the inserted triangular piece. Then sew across the top to the point of the triangular piece, leaving an opening near the fold. Turn the shoe right side out. Make the other shoe in the same way. Put some stuffing in the toes and then put the shoes on the doll. Sew the top of the shoes to the legs with yellow thread.

THE SWISS DOLL

She is wearing the costume of Bern. Her black-cloth skirt is ankle length, edged with red ribbon or braid. Over the skirt she may wear a white apron. The black-cloth bodice, snug at the waist, is sleeveless and cut low and square in front to show the white blouse with full elbow-length sleeves. An extra V-shaped piece of black velvet, with a beaded design, adorns the front of the bodice. Across the shoulders is a square, black collar. Silver chains are attached to the back corners of the collar, brought under the arms and fastened to sequins at the front corners. The hair is parted in the center and worn in two braids down the back. Make the headdress of a lace frill, tied under the chin with ribbon.

THE FRENCH DOLL

The skirt of this flower-seller of the Riviera is in a vivid color, and may have a strip of black braid about an inch above the hem line. Taffeta would be a good choice for the apron, in black or color, with an edging of black lace. A wide shawl, flowered or plain with a fringe, is worn over a short-sleeved white blouse. The cartwheel hat is of light-yellow straw. For the basket, make a circle of a strip of straw ¼″ wide, fastening the ends together. Then paste a small piece of net on the circle to form the basket sides. Black ribbon is attached to the basket, so that it may hang from the doll's neck. The flowers could be cut out of some material with a pattern of tiny blossoms.

The gay Mexican doll, with long, rippling skirt.

The Chinese and Hopi Indian dolls make their bows.

THE MEXICAN DOLL

Her gay costume is worn for a fiesta. The flared skirt, in vivid colors, is pleated or ruffled, and above it is a frilly white blouse. An embroidered sash adds more color; and to be truly Mexican, the doll should wear bracelets and beads. A flower might be tucked in her dark, loosely braided hair.

THE HOPI INDIAN DOLL

A sleeveless, tunic-like jacket dress is worn over a long-sleeved blouse, narrow at the wrists. White cotton cloth makes the trouser-like wrappings around the legs. (On real Hopi girls, buckskin is wrapped around the legs as protection from snake bite.) The doll also wears soft moccasins, a brightly colored sash and a necklace of beads.

THE CHINESE DOLL

The simple jacket-like blouse is made of brocade; but you may make it from a plain piece of material. Sketch a flower design on it and then embroider it in bright colors. The doll wears white stockings and black cloth shoes. The trousers are full at the ankle; and each trouser leg is made separately and sewed to the leg. The jacket hides the stitches.

THE MADEIRA DOLL

This costume is worn by girls in the Madeira Islands, in the North Atlantic. The dress is of red wool, perhaps flannel, embroidered in wool. It is sleeveless. The blouse part has a design of two large blue flowers, rather like daisies, and is laced with purple wool, tied in a bow at the top. The lower part of the skirt is embroidered in white and blue yarn, in the design shown in figure 10. Above the embroidery, the skirt has green polka dots.

The upper part of the apron is of white cotton, embroidered in yellow around the hem and across the center. The lower part of the apron is of red wool, and the yellow embroidery is continued around the hem. In the center of the apron there are three yellow flowers and six blue flowers. A short gathered ruffle, of white cotton, is worn around the waist; the edge is cut in a sawtooth design. Attached to the waist of the doll is a pouch-like bag; it is embroidered as shown in figure 11.

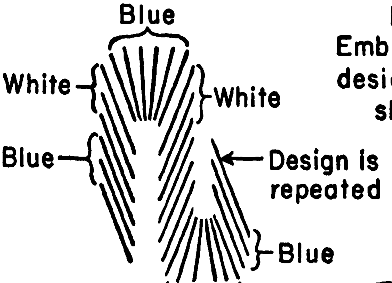


Fig. 10 Embroidery design for skirt

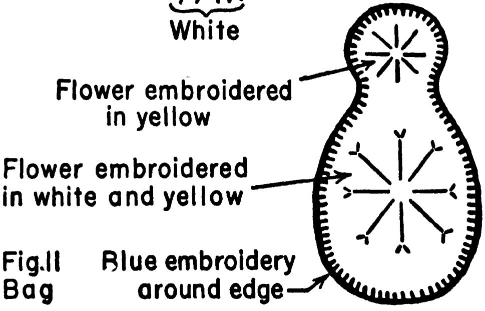
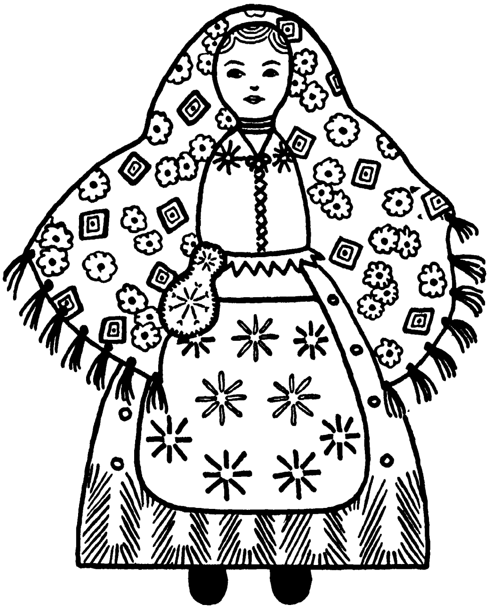

Flower embroidered in yellow
Flower embroidered in white and yellow
Blue embroidery around edge

Fig. 11 Bag



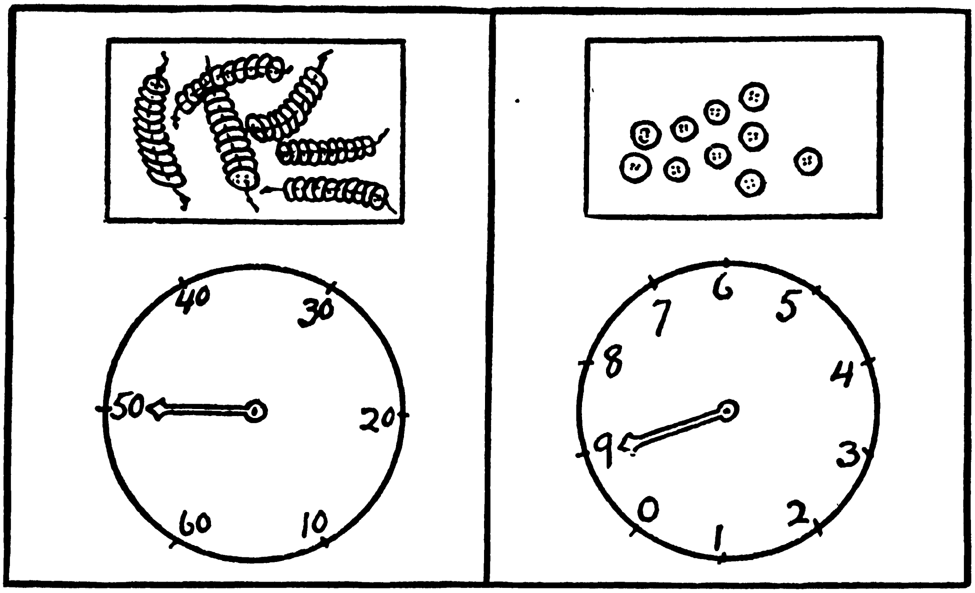
A riot of vivid color, the scarfed Madeira doll.

The doll's tiny black shoes are stitched right onto her legs. A few strands of red wool about the neck give her a necklace. Her hair is of brown wool. Over her head she wears a large scarf, of red-and-white printed material, with blue fringe. This scarf falls below the waist in front and comes to a point at the back.

The pictures in the articles on foreign countries in *The Book of Knowledge* will give you ideas for other dolls. For more elaborate dolls, the following books are useful: *Dolls to Make for Fun and Profit,* by Edith Flack Ackley, Frederick Stokes Company, New York; *On Making, Mending and Dressing Dolls,* by Clara Hallard Fawcett, H. L. Lindquist Publications, New York; *Doll-Making at Home,* by Grace Lovat Fraser, The Studio, London and New York; *Homemade Dolls in Foreign Dress,* by Nina R. Jordan, Harcourt, Brace and Company, New York; *The Story of Old Dolls and How to Make New Ones,* by Winifred H. Mills and Louise M. Dunn, Doubleday, Doran and Company, Garden City, New York; *Soft Toy Making,* by Ouida Pearse, Sir Isaac Pitman, Ltd., London.

By JANET P. JOHL.

THE NEXT THINGS TO MAKE AND DO ARE ON PAGE 6955.



String some big buttons together in groups of ten. Take ten extra buttons. Make two cardboard dials with spinners, like those above. Now you can easily teach your little brother or sister how to count.

WHY DO WE COUNT IN TENS?

YOU may well ask why we count in tens, for it would often be more convenient if we counted in twelves. A system of counting by twelves would be called duodecimal. Our present way of counting, as you know, is the decimal system. The Duodecimal Society of America has worked out a system of counting by twelves. In this system two extra symbols are used for 10 and 11. The number 12 is written 10; 11 stands for 13; 12 for 14; 100 for 144 (twelve times twelve instead of ten times ten).

The fact is that, while ten can be evenly divided by only two figures, two and five, twelve can be evenly divided by four figures, two, three, four and six. Thus, for many purposes it would be better to count in twelves, and, indeed, we often do so when we can, as, for instance, by making twelve inches a foot, and twelve eggs a dozen. This is also the number of months in the year. But we count in tens still, as a rule, and if you remember how you sometimes used to count when you started arithmetic, you will guess the simple reason why. It is because we have ten fingers. When we count on our fingers, as children do, and as early men did, it is natural to make a fresh start after ten, because then we go back to the finger we began with. So all over the civilized world today we find men counting by tens, but our knowledge of languages and of primitive tribes shows the existence of number systems other than the decimal system.

We find traces of some of these other systems in our language. In order to refer to an event 87 years past, Abraham Lincoln used a number system based on 20 when he opened his Gettysburg Address with the words, "Fourscore and seven years ago . . ." In the decimal system 87 is indicated by $8 \times 10 + 7$, but as used by Lincoln, 87 is indicated by $4 \times 20 + 7$. The number system based on 20 was derived by tribes who counted on fingers and toes.

The French spoken and written language still uses more than a trace of the 20 system. For 80 they say "four twenties." For 81 they say "four twenties and one," and so on. For 90 they say "four twenties and ten." For 99 they say "four twenties and nineteen."

Five, the number of fingers on one hand, has also been the basis of a number system, but in this form it was often combined with the systems based on 10 and 20. In fact, so closely related are fingers and counting that our word "digit" means either a finger or one of the numerals from 1 to 10. Two, four and other numbers have also served tribes as the bases for number systems.

It would seem that the systems based on the higher numbers like 10 and 20 were required when men began to herd cows and sheep in large numbers.

WHEN WILL MONEY HAVE DOUBLED ITSELF AT COMPOUND INTEREST?

The number of years an amount takes to double itself at any rate of compound interest not exceeding 10 per cent per annum (year) is approximately the number 70 divided by the rate per cent of the interest.

Thus $100 loaned at compound interest at 5 per cent would become $200 in about $\frac{70}{5}$ years, or 14 years. The same sum loaned at simple interest at the same rate would double itself in 20 years.

CAN WE SQUARE A CIRCLE?

Squaring the circle is one of those curious and impossible tasks, like searching after perpetual motion, that have occupied men's minds through the centuries and led to much waste of time and energy.

The problem is to make a square exactly equal in area to a given circle. This may seem easy, and so it would be if we knew how to calculate the exact area of a circle, for we should simply find the square root of the area and make a square with that as the length of its sides. For instance, suppose we had a circle with an area of 100 square inches. The square root of 100 is 10, and a square with sides of 10 inches, would have an area of exactly 100 square inches.

But if we do not know how to find the exact area of a circle, what can we do instead? There is a formula that is good enough for most practical purposes. We multiply the radius of a circle by itself and then by 3 and $\frac{1}{7}$—or, more accurately, by 3.1416. That number is the ratio of the circumference of a circle to its diameter, and mathematicians call it by the Greek letter π, pronounced *pi*.

But that is what mathematicians call a surd—a number that can not be expressed exactly by any figures. For all practical purposes it is near enough, when worked out to four or five decimal places: 3.14159; but, after all, that is only approximately correct, though the error may not exceed one part in thirteen millions. In 1705 a mathematician named Abraham Sharp worked it out to 172 decimal places, and in 1873 a man named Shanks worked it to 707 places. It will be seen, therefore, that it is impossible to find the true area of a circle, and we can never make a square with exactly the same area. In other words, it is impossible to square the circle.

Archimedes, the mathematical genius of the ancient world, made the first really scientific attempt to find the relation between the circumference of a circle and its diameter. He drew polygons—or many-sided figures—inside and outside a circle, with all their sides touching the circumference, and reckoned the length of the circumference as being midway between the length of the sides of these two polygons. He came to the conclusion that this ratio was between 3 and $\frac{1}{7}$ and 3 and $\frac{10}{71}$, or between 3.1428 and 3.1408. Seeing that the ratio, as accepted today, is 3.1416, and remembering the very immature state of arithmetic in his day, and the fact that our simple Arabic numerals were not in use, the sum worked out by Archimedes was a marvelous achievement.

HOW MANY WORDS HAS THE ENGLISH LANGUAGE?

Professor Max Müller, who was perhaps the greatest authority of his time on words, put the number of words in English at 100,000. He compared the growth and development of our language with the putting of grain in a sieve. Most of the chaff has been winnowed off, and with it have gone many good grains. A great many good old English words remain only as dialect words. There are also a great many newcomers that have not yet found their way into the formal language but that are on the fringes and may one day be admitted. If we include all such old and new words, we shall have to put the total of English words at over 300,000.

The number is constantly growing. Words have to be invented for new industries, and they become part of the language. When a new dictionary was made some years ago, it was found that the new words made necessary by electricity numbered over 4,000. A similar increase had taken place with regard to other arts and sciences. Most of them are purely technical words, but little by little they become common words. And so the language grows.

In ordinary reading and writing, of course, we do not use a tenth of the words in the dictionary. The average educated man or woman uses from 3,000 to 5,000 words, but a person can manage very well with a few hundreds. Even some famous authors use a comparatively small number of words. Milton, for example, used only 8,000. Shakespeare used 15,000.

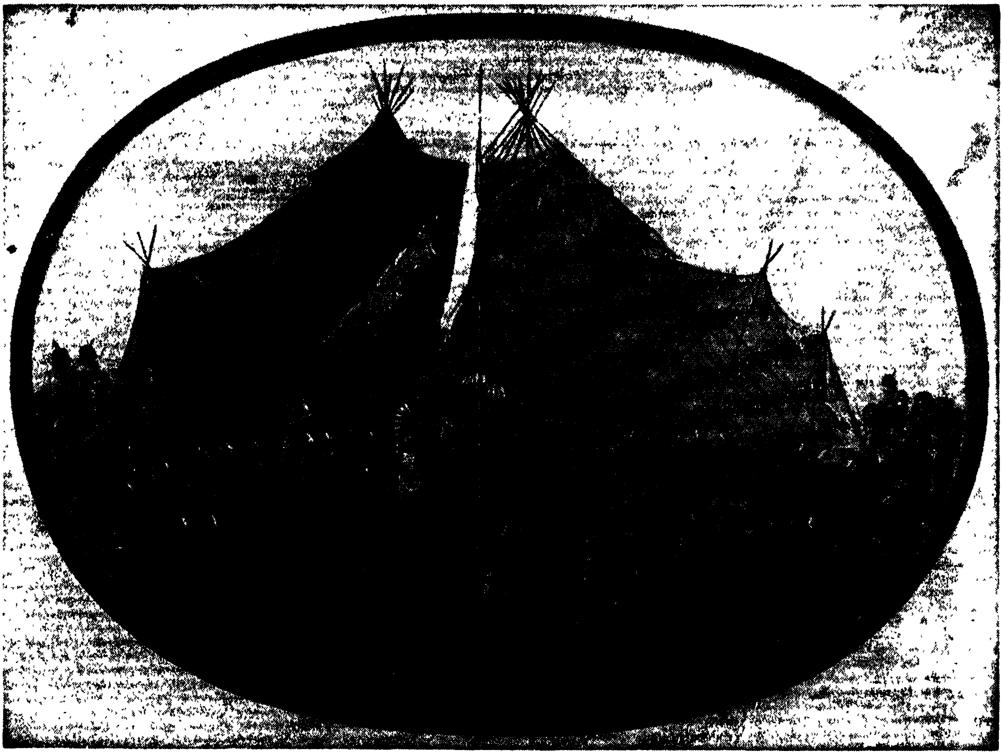
WHAT IS THE INDIAN'S PIPE OF PEACE?

The Indian pipe of peace, called the calumet, after the reed from which it is made, is a long pipe in which tribes, especially those of North America, smoked dried leaves of tobacco or other aromatic plants. The greatest veneration was attached to the calumet, which the Illinois tribe said originated from the sun itself. It is about two feet long, made of varnished earth, and adorned with plaited hair and showy feathers.

The calumet is a symbol of peace, but sometimes also of war. The exchange of the famous pipe between two camps meant an eager desire for friendliness. On the contrary, any chief refusing to smoke a calumet offered to him was considered an enemy. It amounted to a declaration of war.

HOW DID THE BREECHES BIBLE GET ITS NAME?

The curious name Breeches Bible is often given to the English, or Genevan, Bible of 1560, which was translated principally by Puritans at Geneva. The word rendered "aprons" in Genesis III.7 in the Authorized Version of 1611 is, in the Genevan Bible, translated "breeches." Other versions of the English Bible have odd names because of some mistake or curious translation. In what is known as the Printer's Bible, Psalm CXIX.161 is misprinted, "Printers have persecuted me without a cause," "printers" being substituted for "princes." Tyndale's New Testament of 1538 is often called the Wife's Bible because II Corinthians X.II is rendered, "Think on his wife," intended for "Think on this wise." The second edition of the Genevan Bible, 1562, is called the Whig Bible, because in the Beatitudes we read, "Blessed are the place-makers" (instead of "peacemakers"), and the political opponents of the Whigs said they made lucrative posts for their friends. Another Bible is called the Servant Bible, because Genesis III.I is mis-



American Museum of Natural History, New York

This painting by George Catlin shows Sioux Indians smoking the pipe of peace at a feast.

Actors in a scene from the most celebrated Passion Play of modern times, at Oberammergau, Bavaria.

printed, "Now the servant [instead of "serpent"] was more subtle than all the beasts of the field." In the Judas Bible, Matthew xxvi.36 is given as "Then cometh Judas [instead of "Jesus"] and his disciples" The Pagan Bible is an old version that contains a woodcut of Mount Olympus and the heathen gods. In the Vinegar Bible, printed at Geneva in 1717, the word "vinegar" is substituted for "vineyard" in the parable in Luke xx. In the Bugges Bible, published in 1551, Psalm xci.5 is rendered, "Be not afraid of any bugges by night." This is not a misprint. "Bugges" is simply the old English word for "bogey" or "bugbear." A somewhat similar instance occurs in the Treacle Bible, 1568, where the word "treacle" is substituted for "balm" in the verse "Is there no balm in Gilead?" Jeremiah viii.22. In the Douay Version of 1609-10 this same word is translated "rosin," and so that edition is called the Rosin Bible.

WHAT IS A PASSION PLAY?

In the early years of the Christian Church, dramatic spectacles were often given, commemorating events in the life of Christ. Those that were concerned chiefly with His last days on earth, when He fasted and prayed in the desert and was betrayed, condemned and crucified, were called Passion Plays. Gradually these came to be a regular feature of the season of Lent. The word "passion" comes from the Latin word meaning to suffer. In the Middle Ages, townspeople took charge of the Passion Plays and a great many cities and villages, especially in Germany, gave elaborate plays in which it was a civic honor to have a part. Gradually, however, the custom declined, until now there are only a few, usually in villages rather than big cities.

The most famous of the Passion Plays is the one at Oberammergau, in Bavaria. Its history is interesting. In 1633 the little town of Ammergau in the Alps was suffering an epidemic of the plague called the Black Death. The people vowed to produce a Passion Play every ten years if they should be relieved of the Black Death. The plague was abated, and the pious descendants of the villagers have continued the play. The first interruption was in 1920, immediately after World War I; the second, in 1940, during World War II.

The performances at Oberammergau are given in a large open-air theater and last for seven or eight hours. There are nearly 700 actors, all villagers; and in some cases the chief parts have been hereditary. Only a man of blameless life is permitted to have the role of Christ.

The story is that of the New Testament, interspersed with scenes from the Old. The words are in fine dignified prose, and there is a musical score of classic beauty. Thousands of people visit the village of Oberammergau during the years when the Passion Play is presented; and they carry away with them the memory of a tragic yet thrilling performance, staged with genius.

WHAT LANGUAGE WAS USUALLY SPOKEN BY JESUS CHRIST?

There is a great group of languages that are all classed as Semitic. Among these languages are some that are named after the old word for Syria, the word Aram. It was one of these Aramaic languages that was spoken by Jesus, for before his time Aramaic had become the language spoken in Palestine. We can learn a lesson here. The Aramaic language itself is not a beautiful one to hear. The words are not beautiful so far as their mere sound is concerned. Nor is this what would be called a highly developed language. It is far from being so. The language which Jesus spoke was humble, and so in keeping with everything else that we know about His life. Yet in this humble language, Jesus said the noblest and most beautiful things that have ever been uttered on earth. In whatever language they are now spoken, they are no less beautiful.

HOW DID THE RED CROSS SOCIETY GET ITS EMBLEM?

The red cross on a white ground (the Swiss flag reversed) is the emblem of the Red Cross societies. These societies for the care of the wounded in war were established under the Geneva Convention of 1864. By this convention it was agreed that the hospitals, ambulances and their attendants showing this badge should not be fired upon or otherwise molested in their work. Originally the badge was a Maltese cross (✠) similar to that worn by the knights of the Crusades. Now the plain Greek cross (+) is used. This emblem stands for help in disaster as well as in war.

HOW DOES RUBBER RUB OUT INK?

When a rubber rubs out ink or pencil marks from paper, or pumice stone rubs out ink stains on our skin, what happens is really the same in every case. The rubbing, or the friction, actually rubs away the outer layers of the paper or the skin, and so removes anything that they may contain. A soft rubber rubs away only the surface layer of paper, but that is enough for pencil marks, which deposit only a thin layer of carbon on the surface of the paper. A harder rubber—or a knife edge, which acts in exactly the same way—will rub off a thicker layer of paper, and so will remove ink marks, which penetrate much more deeply into paper. Pumice stone is hardest of all, and when we rub our fingers with it, it removes a layer of our outer skin, which has absorbed the ink.

HOW ARE THE MARKS PUT INTO WRITING PAPER?

If we hold a piece of writing paper up to the light we usually see a number of fine lines, words such as "laid," or "wove," and possibly some device such as a lion or a crown, which are almost transparent compared with the rest of the paper. Such markings are called watermarks. They are not printed on the paper with a sort of invisible ink, but are put on in the process of making the paper—and are part of the paper itself.

When the paper is being made, it passes through the machine as a flat web of pulp. When freed from most of its moisture, it passes under a roller known as a dandy roll. This roll is covered with wire gauze, and on the gauze is fastened the lettering or design. The roll revolves over the surface of the wet stuff, and the projecting design is pressed down upon the paper, which thus becomes thinner where it comes in contact with the design. Watermarks are a special feature of bank notes and stamp paper, and are of great interest to collectors.

WHY IS IT DIFFICULT TO WRITE ON GLASS?

Writing is the transfer of some colored material to a writing surface; and the colored material and the surface must both be suitable for the transfer. When, for instance, we write with ink on paper, the ink flows off the pen on to the paper and is, to a slight extent, absorbed. If the paper is too glossy and shiny, the ink flows too widely, and if, on the other hand, the paper is too absorbent, the ink spreads and blots. So, in the case of a lead pencil, the paper must have a certain amount of roughness to rub the particles of lead off the point of the pencil.

Now, glass is suitable for neither ordinary ink nor pencil, because it is smooth and non-absorbent. The ink runs over it, and the lead pencil transfers no lead to it. If we wish to write on glass we must use ink or lead prepared specially to make them sticky, or some other substance.

WHY DOES BLOTTING-PAPER ABSORB INK?

Most papers absorb ink, some more than others. We depend on this fact when we write with a pen, and when we print. When ink dries, the watery part has evaporated into the air, while the solids have remained in, and on, the paper. But a paper of loose texture, with a rough, unfinished surface, like blotting-paper, absorbs ink as a sponge sucks up water; and the water of the ink, instead of mainly remaining on the outside of the paper until it dries, runs into the substance of the paper. That is why the letters are blurred when we write on blotting-paper.

THE NEXT WONDER QUESTIONS ARE ON PAGE 6630.

Incident at a ballad-singing competition in the days of the troubadours.

THE LITERATURE OF FRANCE: I

WHEN the great Julius Cæsar became consul of Rome in 59 B.C., the country that we now call France was inhabited by a warlike Celtic race and was known to the Romans as Gaul. Cæsar conquered the land of Gaul in a series of brilliant campaigns (58-50 B.C.) and thereafter it was a Roman province. In course of time the Celtic language all but disappeared from the region. It was replaced by the Latin tongue of the conquerors, though a few Celtic words remained.

The Roman Empire fell in the fifth century under the blows of the German tribes to the north. The province of Gaul lost its contact with the Italian peninsula, particularly after it was conquered by the German warrior tribes who were known as the Franks. Gradually, the Latin spoken in the province underwent a series of striking changes. In the course of time it developed into two different languages: French, in the north; Provençal, in the south.

Provençal is always treated as an entirely different language from French. It developed a great literature in the Middle Ages but declined after that time. Nowadays educated people in both Southern and Northern France speak and write the French language. However, various Provençal dialects are still used by country people in the South and efforts have been made by certain writers of Southern France to revive Provençal as a literary language.

In this article and in the one beginning on page 6711 we shall tell you about the French language and about the great literature that has been written in that language.

French literature in the Middle Ages is generally divided into two main periods. The first, known as the Old French period, extends from the year 842, when we have the first document in the French language, to the year 1325; the second or Middle French period extends from 1325 to the end of the fifteenth century.

The Old French period is marked by the rise and development of feudalism, about which we tell you elsewhere. The ideals of chivalry—obedience to the knightly code of honor and devotion to womankind—come to the fore. The Church has an important place in the hearts and in the daily lives of the people.

Old French, the language of the period, was not the same in all the provinces of Northern France, for each province had its own dialect. When we say, therefore, that a work was written in Old French, we mean that it was written in one or another of the many dialects of Old French. These dialects differed from one another about as much, say, as the English spoken by a London cockney differs from that used by a farmer of the American Middle West.

From the ninth century to the beginning of the twelfth, French literature has little to offer. There are a few religious poems of no literary value and a number of scattered fragments which are of interest only to historians of the period. It is not until the twelfth century that literary documents begin to be plentiful.

THE LONG EPIC POEMS KNOWN AS CHANSONS DE GESTE

The productions most truly representative of the French people at the beginning of the twelfth century were the epic poems known as the *chansons de geste* (songs of exploits; *geste* is derived from the Latin word *gesta,* meaning deeds). Over a hundred of these poems have been preserved; they were written over a period of several hundred years. The *chansons de geste* varied greatly in length and subject matter. They came to be divided into several cycles, or groups. One group dealt with the brave deeds of Charlemagne and his family; another with the struggles of the Southern barons against the Saracens; a third with the strife of the feudal lords among themselves.

THE SONG OF ROLAND, AND OF HIS BETRAYAL AND DEATH

The Song of Roland was the greatest and probably the earliest *chanson de geste;* it goes back to the first years of the twelfth century. It tells how the traitor Ganelon had his stepson Roland appointed to the command of Charlemagne's rear guard and how he then conspired with the Saracens to betray Roland; how Roland and the rear guard were surprised by the Saracens in the narrow pass of Roncesvalles in the Pyrenees; how Roland refused to blow his horn to call for aid until it was too late; how all the members of the rear guard died on the field of battle; how their deaths were avenged by Charlemagne, who routed the Saracens and put Ganelon to death.

The Song of Roland is written in simple language and its characters do not stand out very clearly. Yet it has great dramatic power and it sounds a lofty note of unselfish patriotism and religious devotion. It is a remarkable poem, considering that it is the first long work in French that has come down to us. The Song of Roland was very popular in the Middle Ages. It was translated into a number of languages; it was the subject of many Old Spanish ballads; it inspired two great Italian poems, Orlando Furioso (The Madness of Roland), by Ariosto and Orlando Innamorato (Roland in Love), by Boiardo. Orlando is the Italian form of Roland.

THE ROMANTIC POEMS ABOUT KING ARTHUR AND HIS KNIGHTS

Other important *chansons de geste* included Raoul of Cambrai, Aliscans, Huon of Bordeaux, the Pilgrimage of Charlemagne and The Saxons. The *chansons de geste* did not survive the Old French period, which, as we saw, came to an end about 1325.

About the middle of the twelfth century there appeared another form of long poem, called the romance—a story-poem that lacked the epic qualities of the *chansons de geste.* Among the most interesting works of this type are the romances of Brittany, based in large part on Celtic tales about King Arthur and his knights. The Norman conquest of England in the year 1066 had brought Frenchmen in contact with these stories, which had originated with the old Celtic inhabitants of England.

The most famous writer of romances of Brittany was Crestien de Troyes, who wrote in the latter part of the twelfth century. In such works as Erec and Enid, The Knight of the Cart, Yvain and Perceval, Crestien shows great skill as a story-teller. He tells fascinating stories of mysterious quests, bold knights, fair maidens in distress, evil giants and magic fountains. His people, too, are real people, with faults and virtues of actual, live men and women.

THE LOVE-STORY OF TRISTAN AND THE TWO ISOLTS

One of the most popular stories taken from Celtic sources was the legend of Tristan. Tristan is sent to Ireland by his uncle, King Mark of Cornwall, to fetch the King's bride-to-be, the fair Isolt. Through a mistake Tristan and Isolt swallow a magic love-drink and thereafter they love each other madly. Seeking to forget his love, Tristan goes to Brittany and there marries another Isolt—Isolt of the White Hands. Falling ill, Tristan sends for Isolt the Blond, who alone can cure him. When the boat that is to bring her to him comes into view Tristan sees that it has a black sail. Thinking that his loved one is dead, Tristan falls lifeless. Isolt the Blond does not long survive him.

Two Old French poets, Béroul and Thomas, wrote poems based on this legend about the middle of the twelfth century. These were the earliest versions of the Tristan tale, which later appeared in a number of other European literatures. In the nineteenth century the German composer Richard Wagner wrote an opera based on the story.

There were many other romances in Old French. Some, like the ones previously mentioned, had a Celtic background. Others, called antique romances, were based on Latin sources; they told of Alexander the Great, of the warriors of Thebes, of the siege of Troy. Still others, like the delightful Floire and Blanchefleur, were derived from Oriental sources.

THE CHARMING TALE OF AUCASSIN AND NICOLETTE THAT IS STILL READ

There is a charming Old French work that is sometimes called a romance. It is the story of Aucassin and Nicolette, written by an unknown poet about 1200. The work, which has alternating passages of prose and rhyme, tells of Aucassin, a count's son who loves the fair Nicolette. When Aucassin's father proposes to marry the youth to a noble lady, Aucassin runs off with Nicolette. The lovers are separated by pirates but are later united; they marry and live happily ever afterward. The author of Aucassin and Nicolette was a genuine literary artist whose characters live. Though the background of the tale is sometimes fanciful, it often reflects the author's own times. He has a deep sympathy with the poor and down-trodden. There are, for example, few passages in medieval literature more pathetic than that of the ploughboy who has lost one of his oxen and does not dare return to his master, yet is worried, because his mother is sick and needs his support.

THE FABLIAUX GIVE A GOOD ACCOUNT OF FRENCH LIFE IN MEDIEVAL TIMES

Perhaps the finest short poems in Old French are the *fabliaux,* or tales in verse, which are sometimes moralizing, sometimes satirical and sometimes merely entertaining. The stories found in the *fabliaux* have been used by writers in every age and in many different lands—men like the Italian, Boccaccio, the Englishman, Chaucer, the Frenchman, Molière and the German, Lessing. The *fabliaux* are generally very realistic. They give us a much more faithful account of medieval French life than the pompous *chansons de geste* or the flowery romances.

There is a type of literary composition—the allegory—in which the events and persons mentioned in the narrative are symbols that stand for something quite different. In the chapter beginning on page 5543 we give you several passages taken from the greatest allegory in English, John Bunyan's Pilgrim's Progress.

THE ROMANCE OF THE ROSE, BEGUN BY ONE POET AND COMPLETED BY ANOTHER

Old French produced a remarkable allegory, The Romance of the Rose, which is considered by some critics as the greatest work in Old French literature. It is a long poem of about 22,000 lines. The first 4,000 lines were written about 1230 by Guillaume de Lorris. The poem was evidently unfinished when Guillaume laid down his pen (for some reason that we do not know). The Romance of the Rose was completed by Jean de Meung about 1270.

The poem is an account of a wonderful dream. In this dream the poet tries to pluck a beautiful rose (in the allegory the rose stands for the love of the poet's fair lady). In the course of the narrative he meets such characters as Idleness, Delight, Cupid, Welcome, Danger, Reason, Slander and so on. Some of them help the poet; others combine against him. At last he is successful in plucking the rose.

The two parts of the poem are entirely different in point of view. The 4,000 lines written by Guillaume make up a sort of essay on love and a description of the trials that a lover should face willingly in order to win his lady. The continuation by Jean de Meung is in an entirely different vein. Jean scorns women. He laughs at the lover who endures heat and cold, hunger and thirst, for a single smile from his fair one. What interests us even more, Jean sums up in The Romance of the Rose his views on a great number of different subjects—life and death, art, religious hypocrisy as opposed to true religion and so on. Some of these ideas were extremely advanced for the time.

The Romance of the Rose was very popular not only in France but throughout Medieval Europe. It exercised a great influence on the greatest allegory that was ever written—The Divine Comedy by the Italian poet and dramatist, Dante Alighieri.

THE ROMANCE OF REYNARD THE FOX IS A SATIRE ON HUMAN BEINGS

Satire plays an important part in The Romance of the Rose. It is all-important in another long poem known as The Romance of Reynard. This work was written by several different authors, none of whose

From an old print

The Romance of Reynard is a satire on society in the feudal ages. The characters are beasts, but they have human traits. The poem, which contains more than 24,000 verses, was written by several different authors.

names we know. Parts of the poem go back to the twelfth century but the greater part was written after 1200. The characters in The Romance of Reynard are all animals, but they have human traits. The poem is modeled on the literary form known as the Æsopic fable, in which the characters are often (though not always) animals. We give a number of Æsop's fables in this book (see the Index, under the name Æsop).

The Romance of Reynard tells of the tricks played on the other animals by Reynard the Fox, a sly and quick-footed rogue. The story is delightful, but underneath the fun we can read a sharp attack upon the evils and injustices of the medieval world.

Lyric poetry is abundant in Old French. Some of these medieval lyrics, particularly those which originated among the people, are charmingly simple and sincere. Those which followed the inspiration of the Provençal love poetry are generally dull pieces. The poet repeats his fair lady's praises like a schoolboy dutifully reciting a lesson.

Artistic prose writing (that is, prose used in literary composition as against that used in legal documents and the like) comes much later than poetry, in Old French. The first outstanding prose work is a historical narrative—The Conquest of Constantinople, by Geoffroy de Villehardouin (1160-1212?). This is an account of the Fourth Crusade, in which a party of crusaders directed their efforts, not against the infidels in the Holy

Land, but against the Christians in the city of Constantinople. Villehardouin had taken part in this campaign. His work is a description of the principal events in the siege of Constantinople; it is also an attempt to justify the attack upon that city. The Conquest of Constantinople is matter-of-fact, clear and logical, but quite lacking in picturesque details.

JEAN DE JOINVILLE'S FRIENDLY BOOK ABOUT KING LOUIS IX

An entirely different sort of historical work, also in prose, was composed in the first years of the fourteenth century by another crusader, Jean de Joinville (1224-1317). In his Book of the Holy Words and Good Actions of Saint Louis, Joinville tells of his good friend, King Louis IX of France, who had been made a saint by the Church. Joinville's book is rather a friendly chat than a serious historical study. He is not much interested in statecraft, but he does give us a series of very entertaining anecdotes that give us a clear picture of the good king, as well as of Joinville himself.

After the first quarter of the fourteenth century, a great change took place in French literature, and the Middle French period was ushered in. Feudalism was now rapidly disappearing, and some of the literary forms that had flourished in the atmosphere of feudalism were no more. There were great changes in the language, too. The Francian dialect (spoken in the Duchy of France, of which Paris was the capital) crowded out all the other dialects in the field of literary expression. From now on it was not referred to as Francian but as French and it became the only literary tongue. It underwent great changes in the Middle French period. Word forms were altered; sentence structure became simpler; many new words were added.

As for the dialects that had been displaced by Francian, they did not disappear, but they were used by more or less uneducated country people. To-day these dialects are still to be found in the country districts of France.

THE CHANGES THAT TOOK PLACE IN THE MIDDLE FRENCH PERIOD

The *chansons de geste* and romances disappeared from the scene in the Middle French period; some of the older poems, however, were rewritten in prose and these new versions won considerable favor. Lyric poetry was more popular than ever, but it was notable for quantity rather than for quality. There were only two first-rate poets in this period, but they are still worth reading.

The first of these, Charles d'Orléans (1391-1465) was a man of royal blood. He was captured by the English at the battle of Agincourt, in the Hundred Years' War, and spent the next twenty-five years in captivity in England. It was during this period that he wrote his verses. Charles was a very optimistic and carefree sort of person and this attitude is reflected in his writing. His graceful poetry is marked by a cheerfulness that refuses to see the ugliness and misery in the world.

FRANÇOIS VILLON, POET, SCHOLAR, VAGABOND AND THIEF

If the poetry of Charles d'Orléans is often exquisite, it is hardly ever profound. A deeper note is struck by a man who was a sad scamp, but a genius. He was François Villon (born in 1431), a Master of Arts of the University of Paris, a thief and perhaps a murderer, who at one time was sentenced to be hanged. (He was later banished from Paris instead.) Villon wrote comparatively little verse. Most of it is contained in two collections, the Little Testament and the Great Testament. In these he makes a number of imaginary bequests to friends and foes alike. From time to time he interrupts the listing of these bequests with ballads and other poems which rank among the finest in all French literature.

THE NOTE OF SADNESS IN VILLON'S BALLADS

Some of these poems continue the mocking vein of the bequests. In others the poet has set forth his uneasy vision of the emptiness and sadness and terror of life. The emptiness of life is expressed in the famous Ballad of the Ladies of Yore, in which Villon tells of the fair dames whose names were once on everybody's lips. Where are they now? "But where are the snows of yesteryear?" Sadness is the keynote of the Ballad of Prayer to Our Lady, in which the poet represents his poor old mother trying to ease her burden of sorrow by praying to the Virgin in her simple but sincere way. There is sheer terror in The Ballad of the Hanged Men, written when Villon was in prison awaiting execution on the gallows.

The art of historical writing makes a notable advance in the Middle French period in the Chronicle of Jean Froissart (1337?-1410?). In this work, Froissart tells of the Hundred Years' War between France and England. He shows no great interest in the political background of the war. As a vivid narrator, however, Froissart has few equals. His style is colorful and dramatic; his descriptions of the battles of Crécy and Poitiers are masterpieces of their kind.

Shrewd Philippe de Commines (1445?-1511) writes in an entirely different vein. His Memoirs give a remarkably penetrating account of the statesmen of the time, including his friend and patron, Louis XI of France. Commines' point of view is often objectionable; like the Italian Macchiavelli, he believes that in order to attain one's purpose one should adopt any means, good or bad. Yet Commines has rendered historians a great service by teaching them to seek for the hidden motives that shape history.

THE RELIGIOUS PLAYS THAT WERE CALLED MYSTERIES

There was a great development of the drama in the Middle French period. The serious dramas known as mystery plays, or simply mysteries, were performed before great crowds of spectators in the city squares; as the plays were very long, performances generally lasted several days. Most of the mysteries dealt with religious subjects, though some were based on historical or legendary events. The most famous play of this sort was Arnoul Greban's Mystery of the Passion (Passion here refers to the sufferings of Christ), written about the middle of the fifteenth century.

The mystery was a serious production, though it was often provided with comic interludes. Middle French also had its comedies, which did not pretend to do anything but amuse. The greatest of these was the Farce of Master Pathelin, written by an unknown author about 1470. Most of the characters of this farce are rogues, who delight in cheating one another. There is the rascally lawyer, Pathelin; the would-be clever draper, who is really a simpleton; the apparently idiotic shepherd, who is the shrewdest of them all. The author succeeds in making them flesh-and-blood creatures. Their doings are set forth with sparkling wit.

Middle French had its occasional masterpieces, but it was a most undistinguished period, on the whole. By the end of the fifteenth century, French literature was standing still. Some writers kept repeating the old literary forms and the old literary themes of the past. Others tried to be original by using strange figures of speech, complicated rhyme schemes and mere ingenious tricks. A favorite verse form, for example, was the acrostic, in which certain letters (generally the first or last letter of each line) made up a name or a phrase. It was evident that French literature was in need of a powerful tonic if it was to regain the prominence it had enjoyed in the Old French period. This tonic was soon to be provided by the intellectual movement that we call the Renaissance or Rebirth.

Western Europe had felt the first stirrings of the Renaissance in the fourteenth century; the writings of classical antiquity had pointed the way. To be sure, many of the Latin classics were known and studied throughout the Middle Ages (Greek was all but unknown at first). Medieval scholars, however, had valued these writings only as historical documents or as literary masterpieces or as models of pure Latin; they had vigorously condemned many of the doctrines of the ancients. Naturally they attacked the belief in gods and goddesses. They also attacked certain tendencies to be found in many ancient writers—the worship of the beautiful rather than of the divine; the search for happiness in this world rather than in the world to come.

The men of the Renaissance studied the Latin classics and, somewhat later, the Greek classics, not merely as models of pure Latin and Greek, but also as guides in the art of living. They joyfully accepted the doctrines of the ancients that we have mentioned above. The name humanism came to be applied to the study of the classics in this new spirit. The humanists, as the apostles of humanism were called, did not have the old medieval distrust of such learning as had no religious purpose. They had an unquenchable thirst for knowledge for its own sake.

HOW THE REBIRTH OF LEARNING CAME TO FRANCE FROM ITALY

The Renaissance, which had first taken root in Italy, made its way to France in the first years of the sixteenth century. It seems to have been introduced as a result of the Italian campaigns of two French kings, Charles VIII and Louis XII. Though they made no permanent conquests in Italy, the French brought back to their country the new ideas that were so widespread in Italy. Soon humanism was in the air in France. Italian scholars went to Paris and Lyons and helped to spread the new culture. Numerous translations were made from the Latin and the Greek. The study of the Greek language made rapid progress in France.

Some writers were quite unaffected by the new ideas of the time. They followed the old literary forms or they adopted the silly novelties that we have described. A typical writer of this sort was the ridiculous rhymester Crétin, whose name has come to mean a person of low mentality.

One poet, indeed, though he still used many medieval verse forms, was far superior to his fellows, because he was a real poet. This was Clément Marot (1496?-1544). He had a stormy life; a favorite of the French king Francis I, he was forced to flee to Switzerland because he was accused of heresy. Like his life, Marot's poetry has its lights and shadows. His Epistles are humorous, sad, satirical and pleading in turn; above all, they are natural.

The greatest humanist in France in the first half of the sixteenth century was François Rabelais (1495?-1553?). He was a monk, an eminent physician and a great scholar who, like Sir Francis Bacon, took all learning for his province. His views aroused the hostility of the authorities of his day. Now Rabelais was a prudent man who was willing to suffer for his ideas but "not to the extent of being burned for them," as he dryly remarked. He resigned his post as curate of Meudon and then disappeared, so effectively, indeed, that no further trace of him was ever found.

Rabelais wrote many learned works but he is best known to-day for his Story of Gargantua and Pantagruel. This work tells of the good giant Gargantua, of his son Pantagruel and of the latter's interesting friends. There is much robust and sometimes inelegant humor in the Story of Gargantua and Pantagruel; there is also a great deal of shrewd observation and of serious discussion of important problems. Rabelais denounced the many restrictions that the Middle Ages had set on men. He believed in freedom; he thought that man, if not hampered by artificial obstacles, would be able to create a new and better civilization.

From an old print

Gustave Doré, artist of the nineteenth century, has drawn in this picture an amusing scene from François Rabelais' Story of Gargantua and Pantagruel. The good giant Gargantua's touching love for his bouncing baby son is laughable, but tender. The story is a satire on life as Rabelais saw it.

The language of Rabelais is astonishingly rich in striking words and expressions—some borrowed from other languages, others invented by the author. Many of these have been forgotten; others have become part of the language. It is estimated that Rabelais contributed some six hundred new words to the vocabulary of French.

An entirely different viewpoint from that of Rabelais was taken by his contemporary Jean (John) Calvin (1509-64). Calvin became the head of the Protestant Church of Geneva in 1539 and was acknowledged as the chief leader of the Protestants. In the work known as The Institution of the Christian Religion, Calvin, like Rabelais, attacked what he considered to be the follies of the past. But, whereas Rabelais had urged that man should work out his own salvation, Calvin had no trust in man's abilities. Man's only hope, thought Calvin, was to give himself up to the mercy of God.

THE SEVEN POETS WHO CALLED THEMSELVES THE PLEIAD

Rabelais had not attempted to apply the ideas of the Renaissance to purely literary forms—such as the epic, the drama or the lyric. Toward the middle of the sixteenth century a group of poets, inspired by Renaissance ideals, broke with the past and determined to rebuild French literature on a new and secure foundation, using the writings of the old Greeks and Romans as guides. These poets were known as the Pleiad (or Pleiades), because they were seven in number and, according to the ancients, there were seven stars in the constellation of the Pleiades. The chief spokesman of the group was Joachim Du Bellay (1524?-60). In the year 1549 he wrote his famous Defense and Enrichment of the French Language, in which he proposed to enrich the French language and French literature, too, by deliberate borrowings from the writings of the ancients.

PIERRE DE RONSARD, THE COURTIER WHO WROTE BEAUTIFUL SONNETS

The poets of the Pleiad proceeded to put the doctrines of Du Bellay into effect. The chief author of the group was Pierre de Ronsard (1524-85). Ronsard, a favorite of several French kings, borrowed liberally from the ancients, particularly in the epic poem called the Franciad. Where this imitation is particularly close, Ronsard is definitely not at his best. Often, however, he keeps his imitation within proper bounds or else he forgets to imitate, and then he writes beautiful poetry. His sonnets are among the greatest in French literature; many lyrical masterpieces are to be found in the collection known as The Loves. Du Bellay, the spokesman for the Pleiad group, was also a poet of great talent; some of his sonnets, particularly in the collection of The Regrets, rank with those of Ronsard. The other poets of the Pleiad were not of the first rank; yet their poetical works were fairly good in quality.

It seemed for a time that French literature was on the right road. The members of the Pleiad group had a dignified idea of the poet's art; they scorned the foolish tricks of Crétin and his fellows. They rejected the outworn poetical forms of Medieval French; they introduced many new and effective metres. If those who came after them had only learned to follow the spirit of ancient literature rather than its letter, all might have been well. Unfortunately, this did not prove to be the case. The doctrine of imitation began to run riot. To the classical models were added still others, particularly the rather extravagant Italian poets of the fifteenth and sixteenth centuries. In the effort to adapt these models to French literature, certain poets felt themselves bound by no restraints. Impossible word formations and exaggerated figures of speech became all too common. In the course of time each poet came to have his own idea of just how the French language and French literature should be enriched. The result was utter confusion.

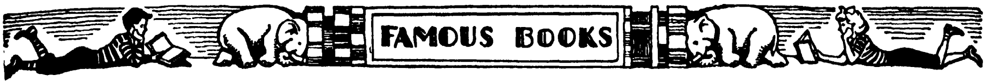
MICHEL DE MONTAIGNE, WRITER OF FAMOUS ESSAYS

The growing anarchy in French literature had its counterpart in the troubled political situation of France in the latter part of the sixteenth century, when a series of terrible religious wars divided Frenchmen into two hostile camps. During this unhappy period there lived in France a man who kept aloof as much as possible from political and literary strife and who studied the eternal problems of mankind in a series of immortal Essays. This man was Michel de Montaigne (1533-92).

MONTAIGNE SEES LIFE AS A FASCINATING SPECTACLE

His Essays seem to have been written as the mood dictated; they deal with an astonishingly wide variety of subjects. Certain general ideas, however, are emphasized throughout. For one thing Montaigne does not have much faith in the powers of the human mind. His most insistent question is "What do we really know?" The answer is invariably "Very little indeed." Yes, we know little and we can do but little in this world. Therefore we should accept things as they are with patient resignation. We should try to consider life as a spectacle, often sad but always interesting. Certainly the spectacle of life, as Montaigne presents it, is fascinating.

THE NEXT STORY OF LITERATURE IS ON PAGE 6711.



The Count of MONTE CRISTO

SOME books are great travelers. Wherever you go they have been there before you and you can always find some one who knows about them. THE COUNT OF MONTE CRISTO is such a book. For over a hundred years people all over the world, both young and old, have been reading it. It is a classic, which means that many years after it was written it still has the power to make friends among new readers.

It would have made the author, Alexandre Dumas, very happy to know that some day the movies and the radio would bring his story to thousands of people who might otherwise never hear of it. For he did not write this novel for a few scholars and teachers. He wrote it for anyone who loves a good story.

THE COUNT OF MONTE CRISTO deals with a great crime committed against an innocent young sailor and the revenge he took, years after, on the men who had wronged him. It is a story of the evil men can do to further their selfish ambitions, and the demoralizing effect of their deeds on their victims. It is also a story of courage and loyalty, of the good that can survive in a generous heart turned vengeful through suffering.

THE STORY

On the twenty-fourth of February, in the year 1815, a crowd of spectators was gathered on the quay of Marseilles, a port on the southern coast of France, to watch the Pharaon sail up the harbor. On the faces of the spectators was a look of anxious curiosity, for although the ship appeared in perfect condition and was coming in under expert handling there was an air of melancholy about her that spoke of disaster. One of the watchers on the quay was the shipowner, Monsieur Morrel. He did not wait for the Pharaon to land, but jumped into a little boat and had himself rowed alongside.

The first mate, Edmond Dantès, who appeared to be in command of the ship, left his post beside the pilot and leaned over the bulwarks to greet the owner. Dantès was a tall, slim youth with fine dark eyes and the assured manner of one accustomed to facing danger.

"You are looking pretty gloomy on board. What has happened?" Monsieur Morrel inquired.

Dantès replied that he had bad news. Off Civita Vecchia the Pharaon's brave Captain Leclère had died of brain fever.

This was indeed bad news to Monsieur Morrel, for Leclère had been an able and trustworthy captain. But he quickly reflected that it might have been worse, for the ship and the cargo, on which the welfare of his business and family depended, were safe. He was deeply impressed with the skill and self-possession manifested by the young sailor in the emergency; and showed his admiration by making known his intention of bestowing on him the captaincy of the Pharaon, left vacant by the death of Leclère.

The ship's purser, an ambitious and scheming young man by the name of Danglars, observed with rancor the respect that the owner of the Pharaon accorded Dantès. Morrel's approbation fanned into bitter hatred the smoldering jealousy with which Danglars had regarded Edmond's authority on the homeward journey. Danglars determined to try to undermine the shipowner's confidence in his rival.

Before Dantès, busy with landing duties, had an opportunity to report to his master, Danglars, therefore, confided to Morrel that, instead of making directly for Marseilles, the ship had been delayed a day and a half off the isle of Elba. Danglars knew this would greatly distress Monsieur Morrel, for Napoleon, whose ambition to rule all Europe had brought France to the verge of ruin,

As Mercédès watches, soldiers take Dantès away.

was living in exile on Elba. It was dangerous business for a ship to drop anchor at the island. Such action might be construed as part of a conspiracy to help the tyrant regain his throne, and make its owner or captain liable to arrest for treason.

Although Danglars' jealousy of Edmond Dantès' command was plainly evident, Morrel did not perceive it. He accepted the confidence in good faith and, in accordance with the purser's intention, asked Dantès to account for his action in delaying the ship off Elba. Dantès, however, could tell him nothing except that the dying captain had entrusted him with a packet to be delivered to the Marechal Bertrand, who was living on the island in Napoleon's service, and that he had no idea what the packet contained.

A DEAD CAPTAIN'S COMMAND LEADS DANTÈS INTO DANGER

To Dantès, true sailor that he was, the dead captain's command had carried the same authority as that of the living. Had he known the risk he still would have obeyed. But he knew little of the dangerous political intrigue growing out of Napoleon's ambitions and exile. He was a man of the sea where danger openly declared itself and could be dealt with for what it was.

Monsieur Morrel was a man who valued integrity of character above all things. He acknowledged Edmond's obligation to execute his captain's last order, and respected him for his loyalty to the code of honor that rules the sea.

Dantès knew that the purser had taken an unfair advantage in reporting the Elba incident before he himself could do so. He had had trouble with Danglars on the homeward voyage. Dantès might have been warned. But he was too trusting and generous to suspect a shipmate of evil, and he made no comment on Danglars' behavior to the owner of the Pharaon. Full of homecoming joy, Edmond left the ship with a singing heart, his eyes on the promising future, unaware of Danglars' envy stalking behind him.

He went first to his father's house, for he was a devoted son and the old man was feeble and completely dependent on him for the things that sustain life. His father was overjoyed to see him, but he gladly released him when, having poured out his earnings, Edmond asked permission to leave him for a while.

"I am anxious to see Mercédès," he explained.

The old man sympathized with his son's eagerness to see his sweetheart after the long separation. "Go, my son, go," he urged. "And may God bless you in your wife as He has blessed me in my son."

A JOURNEY ENDS IN A LOVERS' MEETING

There was no happier man in all France than Edmond Dantès as he took the road to the near-by village of the Catalans where the beautiful Mercédès lived. He had brought the Pharaon safely home. His captaincy was all but assured. His heart beat with pride as he thought of sharing his great news with the girl he loved.

It was a joyous meeting, for the lovers had planned to be married on Edmond's return. But after the first happy embrace Dantès saw that they were not alone. Withdrawn into the shadows of the room a young man sat watching them, with a strangely menacing expression on his handsome face.

Edmond recognized Fernand, cousin of Mercédès, with whom he had a slight acquaintance.

Edmond held out his hand in friendly greeting to the young man, but Fernand withheld his and only responded when Mercédès, with an imperious look, compelled him to do so. Fernand was in love with his beautiful cousin and fiercely jealous of the man who had won her. At the very moment of Edmond's appearance he had been pleading with her to give up her lover and marry him, to which she had coldly replied, as she had many times before to his importunate demands, "I love Edmond Dantès and none other shall be my husband."

AS EVIL GROWS IN A JEALOUS HEART . . .

It was a disturbing note in Dantès happy reunion with the girl he loved. But the joy of the hour was too great for him to perceive any possible threat in Fernand's hostility. Fernand fled from the house like a demented man, crying in his heart, "How can I get rid of this fellow?"

Before he had gone far, however, some one called to him. It was Danglars, the purser, who was sitting with his friend Caderousse drinking wine in the arbor of the village tavern, La Réserve. The arbor looked cool to Fernand and the wine tempting, for he was hot and distraught. He accepted the invitation to join them.

The chance meeting on this day offered Danglars and Fernand an unexpected opportunity to share their jealous hatred of the fortunate Edmond. Danglars boldly took the initiative and before the two men separated they had allied themselves in a plot to destroy their rival. The purser's knowledge of the delay at Elba lay ready to serve them.

Caderousse, who had nothing to gain from the plot and who might have protested, they plied with wine until he easily believed what they told him, that it was a harmless joke they intended to play on the happy bridegroom. Caderousse was a foolish man and a coward, and he was a little afraid of the ambitious and scheming Danglars.

"OPEN THE DOOR IN THE NAME OF THE LAW!"

It was at Edmond's and Mercédès' betrothal feast held at the tavern on the following day, to which the three men had been unsuspectingly invited, that the plot began to unfold. In the midst of the glad celebration there suddenly came the ominous sound of booted feet on the stairs which led to the chamber where the feast was spread; followed by a peremptory command, "Open the door in the name of the law!"

A police officer entered, accompanied by five soldiers.

"Which of you gentlemen answers to the name of Edmond Dantès?" the officer demanded.

Dantès, agitated but resolute, stepped forward. "I do, monsieur. What do you want with me?"

"Edmond Dantès, I arrest you in the name of the law," the officer proclaimed.

Dantès, greatly mystified, asked to be informed of the charge against him. But the policeman could tell him nothing. Monsieur Morrel, who knew him, protested there must be an error. Dantès' old father threw himself pleading at the officer's feet. But resistance was useless. The officer of the law bore a warrant for Dantès' arrest. If a mistake had been made it would be promptly put right. That was the only assurance he could give them.

Mercédès ran sobbing to the balcony and watched the man so soon to have become her husband disappear down the street in the hands of the soldiers.

"Good-bye, Edmond, oh, my Edmond! Good-bye!" she cried heartbrokenly.

Many years would pass before they should meet again. When that day arrived all hope of happiness would long since have vanished forever.

Bound, Dantès gazes toward the dread Chateau d'If.

Edmond knew he was innocent of any crime, and he expected soon to be released to return to his home and his bride. The magistrate before whom he was taken, Monsieur de Villefort, was convinced of his innocence and promised to liberate him. But De Villefort's father had been a Bonapartist, and there were those who looked on the son with suspicion. He was ambitious to secure a high place for himself in the new regime, and his connection with a family suspected of conspiring to restore Napoleon to the throne of France was a serious handicap. The conviction of a man accused as a spy in the banished emperor's service would stand on his record as proof of his loyalty. Furthermore, it would be regarded as a signal service to the state and might even open the way to the political rewards he coveted.

For a deputy of the law, sworn to hold justice sacred above all things, the act he contemplated was one of monstrous perfidy. But the temptation was irresistible.

Under pretext of being compelled to detain Dantès until evening before setting him free, De Villefort had him conducted to a cell. At night soldiers removed him and, placing him in a boat under heavy guard, rowed him out into the harbor to the black rock on which stood the dreaded Chateau d'If, a prison whose name struck terror into the hearts of all who heard it.

In the prison register a new name was entered, Edmond Dantès; beside it a number, 34. The upright sailor of the generous, devoted heart had become a number. His enemies were safe. No specter of revenge would waylay them; for no man had ever escaped from the Chateau d'If. The few desperate men who had made the attempt had all perished on the rocks or been drowned in the sea.

THE MILLS OF THE GODS GRIND SLOWLY YET THEY GRIND EXCEEDING SMALL

In the dungeon of Chateau d'If the endless hours dragged into days, the days into months, months into years. Dulled now were the torment of rebellion and the vain agony of trying to plumb the mystery of what had befallen him. Anxiety for his father and Mercédès had died. The maddening thirst for sun and air had passed. All hope of rescue that had at first sustained him was dead. The horrors of prison life had begun to affect his mind. He could no longer think or feel. Only one way remained out of his misery, death. He decided to starve himself.

A day came when even the moldy bread and putrid meat of his prison fare tempted him. Every cell of his body cried out for food. But he steeled his will and persisted. Finally he could no longer stand. He lay on his cot waiting for death. At night he prayed that he might never waken; each morning was a descent into a deeper hell.

A STRANGE SOUND IN THE DARKNESS OF NIGHT

Then one night toward nine o'clock, from the wall against which he was lying, came a disturbing sound. He had grown so accustomed to the loathsome animals inhabiting the dungeon that he no longer heard them. This sound pierced his consciousness. There was something unusual about it. In all his years in the Chateau d'If he had not heard it. It was like a claw or sharp tool working on rock. A tremor passed through his wasted frame. He managed to sit up, straining his weakened hearing to listen.

For three hours the sound continued. Then there came another, as if something were crumbling away. After that there was silence. But hours later the scraping began again.

Weak as he was Dantès still had strength to seize on a thought no prisoner to his dying breath ever relinquishes: liberty. On the other side of the wall there lived a man who still had hope. The knowledge was like new blood poured into Dantès' veins. As by a miracle life quickened in him. He determined to help his fellow-prisoner.

A pitcher and an iron saucepan were the only materials his bare cell offered for the fashioning of tools. But hope lived again. They would suffice.

PRISONERS 34 AND 27 MEET FACE TO FACE

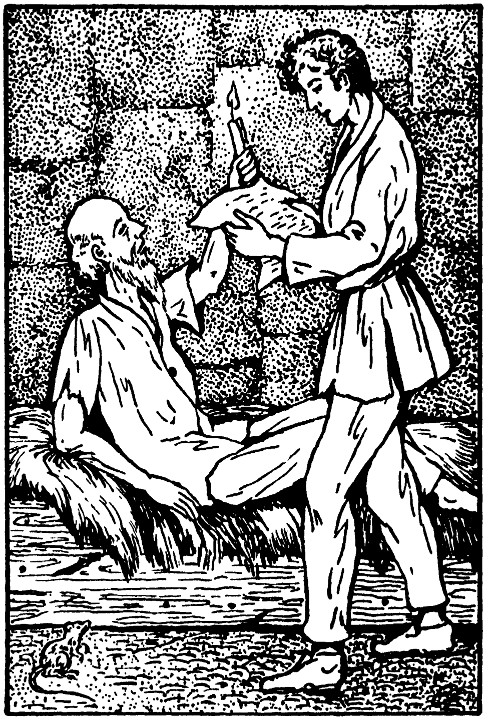
Many days and nights of secret, tireless toil passed before prisoners number 34 and 27 stood face to face and Dantès' terrible isolation was ended. For the first time in years Edmond heard a human voice other than that of his jailor's. The sound filled him with a joy almost too great for his strength to sustain. When the last stone that held them apart crumbled away, he threw himself into the arms of the white-haired man who appeared at the opening as into the arms of a father come to save him.

A light like that of the sun pierced the dungeon darkness; the walls moved out; the air seemed to freshen. He was no longer alone; he had a companion in his captivity. His heart beat so wildly with his new-found happiness it threatened to choke him.

When the Abbé Faria, number 27, a political prisoner, learned that the wall on which he had spent so much heartbreaking toil led only into another cell, he was bitterly disappointed. But Dantès' love and need renewed his courage. He immediately began on another plan of escape, one they would carry out together.

A NEW LIFE BEGINS WITH THE ABBÉ FARIA

From the moment of his meeting with the Abbé Faria a new life began for Edmond Dantès, for the abbé was a remarkable man, a scholar of great ingenuity. In his bare cell he had found the materials for almost everything he needed; chisel, pincers, a crowbar, essential tools for loosening and dislodging the rocks of his prison walls; paper and pen and ink for the writing and study with which he preserved his sanity and filled the hours with productive labor against the day of freedom. For the Abbé Faria was a man born for achievement. He would demand a reckoning of himself for the way he had spent his years in prison.



"This piece of paper is my treasure . . ."

One day the abbé asked Dantès about the circumstances of his arrest and imprisonment. When he heard as much of the story as Dantès could tell him, he said, "There is a maxim which says: If you wish to discover the author of a crime, endeavor to find in the first place who would derive advantage from the crime committed." The abbé set his mind to discovering who the men were who were most likely to gain advantage from disposing of Dantès, and it was not long before his acute intelligence had solved the mystery. There was no doubt that Danglars, Fernand and De Villefort were the criminals, for each of these men had something to gain from Edmond's imprisonment.

When Faria saw, however, the effect of his disclosures on Edmond, he almost regretted having enlightened him. He could see that the knowledge had instilled in his young friend's heart the desire for revenge. He was determined to dissuade him from such action, for he knew the ravaging effect on a man of the desire for vengeance. But Dantès would not listen to the good man's admonitions. He bade him speak of other things. The abbé, shaking his head sadly, said no more.

Under the influence of his friend, Dantès' life underwent a complete transformation. The scholar had awakened in him a great thirst for knowledge, and Edmond asked the abbé to teach him all he had learned in his years of study. "Otherwise," said Dantès, "an ignoramus like myself will only be a bore to you. I am sure that you must prefer solitude to a companion without education."

"It will not take more than two years to give you the knowledge I possess," Faria declared. "Human knowledge is very limited, and when I have taught you mathematics, physics, history and the three or four languages I speak, you will know all that I know."

Prison life has few distractions. Dantès had a quick mind and a wonderful memory and he gave himself to his studies with a will. In a very short time he had made great strides. By the end of a year he was a different person from the untutored sailor who had entered the prison. He was on the way to becoming a highly educated man.

FREEDOM MAY COME TOO LATE FOR THE GOOD ABBÉ

Meanwhile the two men had begun to dig the tunnel required in the abbé's new plan of escape. Though dangerous, the plan was so simple it seemed bound to succeed. But Faria's health was fast failing. It was doubtful whether the day of freedom would dawn for him. He had an attack that left his right arm paralyzed. Even if he lived to break out of the prison walls, he would not be able to swim the long distance to safety.

Dantès swore a solemn oath that he would never leave his friend until death separated them. The sick man protested that he could not accept such a sacrifice. But when he saw that Edmond was immovable he said, "So be it. It may be that you will be rewarded for this unselfish devotion."

He sent Dantès to fill up the tunnel they had dug which, if discovered, would lead to their separation. He bade him spend the whole night on the task if necessary, and asked him to come to see him after the jailor had made his visit in the morning. "I shall have something important to tell you," he explained.

In the morning Dantès found the abbé with a piece of paper in his hand on which something was written. "This piece of paper is my treasure," he said. "You will one day be the owner of it all."

Thereupon he told Dantès the story of a fabulous treasure buried in the caves on the isle of Monte Cristo, a story that made the young man fear his friend's illness had affected his reason. It seemed impossible that such a treasure could exist. But he soon saw that the abbé's mind was quite sound. However, he could not feel he had any right to the treasure. "I am not even related to you," he protested.

Faria denied this. "You are my son, Dantès," he asserted. "You are the child of my captivity. God has sent you to console the man who could not be a father, and the prisoner who could not be a free man."

"FAREWELL! FORGET NOT MONTE CRISTO!"

Not long after this the Abbé Faria died. His last words to Edmond were, "Farewell! Forget not Monte Cristo!"

Overwhelmed with grief, Dantès relinquished all hope of escape. But his friend did him one last great service, for it was through his death that he gained his freedom.

When Edmond Dantès found himself alive after the terrible ordeal of his escape, he remembered the abbé's last words to him. "Forget not Monte Cristo!" As soon as he could arrange for a secret exploration of the island he made his way there. Following the instructions, which he had learned by heart in case anything should happen to the paper on which they were written, he located the caves and found the treasure just as his friend had described it.

His heart beat with a fearful joy. As he surveyed the incredible wealth that had fallen into his possession he knew that his enemies were in his power. In that moment, for the second time in his life, but this time by his own will, Edmond Dantès lost his identity. The sailor of humble origin vanished. In his place stood the Count of Monte Cristo.

A STRANGE MONK VISITS THE INNKEEPER CADEROUSSE

But first, disguised as a monk, he paid a visit to the innkeeper Caderousse. Caderousse received him with obsequious cordiality. Few people stopped at the inn and he hoped his guest would order an expensive wine and leave a little money in his empty cash box. But he soon became wary. He did not recognize the man in monk's garb, but the questions he asked stirred a guilty memory. He made excuses. It would take too long to answer all these questions. And what good would it do?

When the monk, however, drew from his pocket an enormous diamond and, with a

An aloof, mysterious stranger, said to be fabulously wealthy, attracts the attention of passers-by in Paris.

trifling air, dangled it in front of the innkeeper's avaricious eyes, he quickly decided to give the monk the information he had come for.

Caderousse sat down on a little stool and began his story.

Edmond Dantès' father had died of grief. Mercédès had become a great lady. She had married her cousin Fernand, who was now the Count of Morcerf. She had almost fainted on her wedding day when she passed La Réserve, where eighteen months before she had celebrated her betrothal to Edmond. They were living in Paris. Caderousse could not explain how the poor, unknown Fernand had become a wealthy count, but he suspected foul means.

Danglars was a rich banker, also living in Paris. About De Villefort he knew nothing, but supposed he too had done well by himself. Danglars had written the letter that had thrown young Dantès into De Villefort's treacherous hands. Fernand had posted it.

The good shipmaster, Monsieur Morrel, had tried unsuccessfully to obtain a new hearing for Edmond. The shipmaster had fallen on evil times. He was on the verge of bankruptcy.

Caderousse' story corroborated the Abbé Faria's researches into the circumstances of Dantès' arrest. The monk dropped the diamond into the innkeeper's covetous hands and departed.

Soon after, the gloom that had descended on the Morrel family gave way to mystified joy. An unknown benefactor had canceled all the shipmaster's debts and the good man's honor and that of his devoted family were saved.

Some months following these events there appeared in Paris a stranger of fabulous wealth who called himself the Count of Monte Cristo. He was a mysterious figure. Only Mercédès' son seemed ever to have heard of him. Young Albert de Morcerf had met him in Rome and the Count had done him a great service.

Danglars, the banker, could not understand how he had missed hearing of a man who commanded such wealth. He made it his business to know about the men who controlled large fortunes, whether they lived in France or abroad.

All the great houses of Paris, among them

Danglar's, the Count of Morcerf's and De Villefort's, were promptly thrown open to the stranger, for wealth is a password that opens doors quickly. One woman, Mercédès, Countess of Morcerf, whose son was often seen in the company of the Count, watched him with misgiving. But no one gave warning that the day of vengeance was near. Not until the very day dawned did the Count of Monte Cristo name the avenger.

Too late they knew who their guest was. By the day's end the account had been rendered and the last grim payment for the crime against Edmond Dantès had been made. Danglars was ruined, the Count of Morcerf had committed suicide, De Villefort's son was dead and he himself stark mad.

Vengeance had triumphed, but the avenger had lost. As the Count of Monte Cristo looked on the dead face of De Villefort's innocent young son a terrible grief seized him. Gazing with horror on the destruction his vengeance had wrought, he thought of the good abbé who had wanted to deliver him from this hour. And he heard as if spoken the words: "Vengeance is mine, saith the Lord." In anguished penitence he bowed his head and cried to God for forgiveness.

THE AUTHOR

Alexandre Dumas, the man who wrote this story was born on July 24, 1802, in the little town of Villers-Cotterets, about forty miles from Paris. The town was surrounded by a great forest and it was there, with his bird snares and gun, that the future author of the Count of Monte Cristo spent the happiest hours of his boyhood. He was a poor boy. His father had been a great soldier, one of Napoleon Bonaparte's generals. But he had fallen into disfavor and was retired on a small pension. He died when Alexandre was about three and a half years old. After that Alexandre's mother had to make a living for herself and Alexandre and for his older sister. The little tobacco shop which she kept just barely provided the food and clothing and shelter they needed.

When Alexandre dreamed of riches he always thought of the things he would do to make his mother's life easier. He loved his mother dearly. She believed in him when most of the people in the town thought he was lazy and without ambition and would never amount to anything.

From his father Alexandre inherited great physical strength and some of the characteristics distinctive of the Negro race. For his father's mother was a Negro. The name Dumas, which Alexandre was to make famous, was the name of his Negro grandmother.

Many of the pictures you see of Dumas are caricatures. He was a slim and good-looking youth but as he grew older he became very fat. His looks and his eccentric behavior made him an excellent subject for caricature and there were talented men who took advantage of it.

There are many things in the life of Alexandre Dumas that are hard for an ordinary person to understand. He seemed never to grow up and act as one would expect of a grown man. He made several fortunes and wasted them in silly extravagances. He died a poor man with hardly a penny to his name. He was not always honest. He hired men to help him with some of his books, and he gave them little credit and paid them poorly, even when he made a lot of money from the books they helped him to write.

He had many enemies, partly because he was egotistical and often selfish and inconsiderate of others; partly because his genius aroused the jealousy of less gifted men who envied him his fame and fortune.

He was often taunted with his Negro blood. However, he did not let it make him bitter or resentful. By nature he was extraordinarily good-tempered and optimistic. He had a great zest for life and a wonderful capacity for making life exciting for himself and others. He was incapable of holding a grudge against anyone, and could be generous and fair even to men who treated him badly and ridiculed him and his books. He had many rare and fine qualities and in judging the character of Alexandre Dumas they must be given the recognition they deserve.

Dumas lived in a time a little like ours. The Napoleonic Wars had left Europe devastated and France divided into many competing political parties. The country was full of spies and no one knew whom he could trust. It was in this period that he laid the story of THE COUNT OF MONTE CRISTO.

Dumas was not a studious boy. He was much more interested in sports than in Latin and mathematics, and whenever he could he played truant and escaped to the freedom of the forest. He left school early to work in an office in his home town to help make the family living. But his career as a small-town clerk did not last long.

As he left his childhood days behind, a great change took place in him. Paris with its many theaters beckoned, for he aspired to become a dramatist. He had great confidence in his talent, and he thought it would be an easy matter to get one of his plays accepted and quickly to earn the fame and wealth he so much desired. However, when he arrived in the big city, the only job he could find was that of copyist. There were no typewriters then, and anyone with a good hand could always find work copying important papers and letters.

It was tiresome work but he was glad to get it. He was determined to remain in Paris and use the hours after work for study. To a country-bred youth with a great thirst for experience, the attractions of Paris were almost irresistible. But he kept his resolution. Many a night he sat in his little room until dawn and worked. He was strong and happy. He did not need much sleep.

Now that Dumas knew what he wanted, he became a tremendous worker capable of great self-discipline. He had extraordinary talent, but without the capacity for work and self-denial that he manifested during these first years in Paris, he could not have attained, so early in his career, the spectacular success that came to him.

People who do not write often wonder where authors get their ideas for stories. Dumas told us a great deal about the history of his books, and so we know how he came to write THE COUNT OF MONTE CRISTO.

DUMAS' EVENTFUL TRIP WITH THE YOUNG NEPHEW OF NAPOLEON I

In 1842, when he was nearing the height of his fame, Dumas was in Florence, Italy. Unlike many Frenchmen, he was interested in other countries and liked to travel. While he was there he visited Jerome Bonaparte, the brother of Napoleon. Jerome asked Dumas to accompany his son, the young prince, on a tour of Italy to improve his education. It was decided they should first visit Elba, where Bonaparte, the prince's uncle, had spent the months before his last unsuccessful campaign to regain his emperor's throne.

It was on this trip that Alexandre Dumas first saw the little island of Monte Cristo. He wanted to explore the island, but it was uninhabited and there were quarantine regulations that would have held up their ship at the next port if they had set foot on the island. Dumas therefore suggested that they sail around it to learn what they could about it from the sea. The prince asked, "What is the use of that?" Dumas replied, "I intend in memory of this trip with you to give the name of Monte Cristo to some novel that I shall write later on."

The drawing above is of Dumas as a young man; that below is of the successful, middle-aged writer.

Among the many wonderful stories which Alexandre Dumas wrote is another which has captivated the hearts of young people, THE THREE MUSKETEERS. Dumas was probably not thinking especially of boys and girls when he wrote THE COUNT OF MONTE CRISTO and THE THREE MUSKETEERS, but the heroes of these novels are young and Dumas knew how young people feel and act. It is among the young that he has continued to find his greatest admirers.

In almost every school and public library collection these two books are among the titles most popular with boys and girls of high-school age. It would make Alexandre Dumas very happy to know that almost eighty years after his death he still lives as one of the world's great story-tellers.

By HILDA M. GRIEDER.

THIS IS THE END OF THE FAMOUS BOOKS.

FLOWERS OF NORTH AMERICA

FLOWERS OF THE EAST: PART II

THE lovely arethusa, or Indian pink, is common in marshes in June. The flower is an inch or more long, rose-purple in color, and with a bearded lip. The flower smells rather like violets. The one-flowered stem grows from a globular bulb, and is sheathed at its base by a solitary leaf hidden in the sheaths of the stem and protruding after flowering.

Sweet pogonia is another rare but beautiful orchid. It has rosy blossoms and a perfume suggesting ripe red raspberries. The stem is about eight inches high and bears a single ovate or lance-shaped leaf near the middle, and a solitary flower at the summit.

The beautiful calopogon, or grass pink, is a lovely orchid, with a loose raceme of four to twelve delicate pink flowers in a loose cluster at the top of a scape six to twelve inches high. The flowers seem to be upside down, as the tip is at the top. A single grass-like leaf sheathes the stem near its base, as it rises from a solid bulb. This exquisite flower raises its graceful head in deep, wet swamps and bogs, where it can be reached only with some effort and difficulty.

The purple fringed orchid is found in wet meadows in early June. A smaller species appears in July. The lower leaves are oval or oblong, passing into lance-shaped bracts above. The flowers are purple, rather large, and grow in a spike. Each flower has a fan-shaped three-parted lip with fringed divisions, and a long curving spur. Under date of June 9 Thoreau writes: "Find the great fringed orchid out apparently two or three days—a large spike of peculiarly delicate, pale purple flowers growing in the luxuriant and shady swamp—the village belle never sees this more delicate belle of the swamp—only the skunk or owl or other inhabitants of the swamp behold it."

The twinflower belongs to the honeysuckle family. It has a slender, creeping and trailing stem and rounded evergreen leaves. The delicate pink, fragrant flowers grow in pairs, nodding on thread-like upright flower stems. The calyx is five-toothed, and the corolla bell-shaped and five-lobed, and hairy within. The delicious perfume of the nodding pink flowers fills the air and draws one to their home in the cool moss of the woods. This flower is named *Linnaea borealis*, after the great botanist, Carolus Linnaeus. The American twinflower is considered another species by some botanists.

Another pretty flower of the June woods is bunchberry, or dwarf cornel. It has a stem from five to seven inches high, and a whorl of four to six ovate pointed leaves. At first sight the flowers appear like a single white blossom, but a closer look shows us a whorl of white leaves surrounding a cluster or head of small greenish flowers. This whorl of leaves around the flowers has a special name,

If you take a walk on a country lane in June you

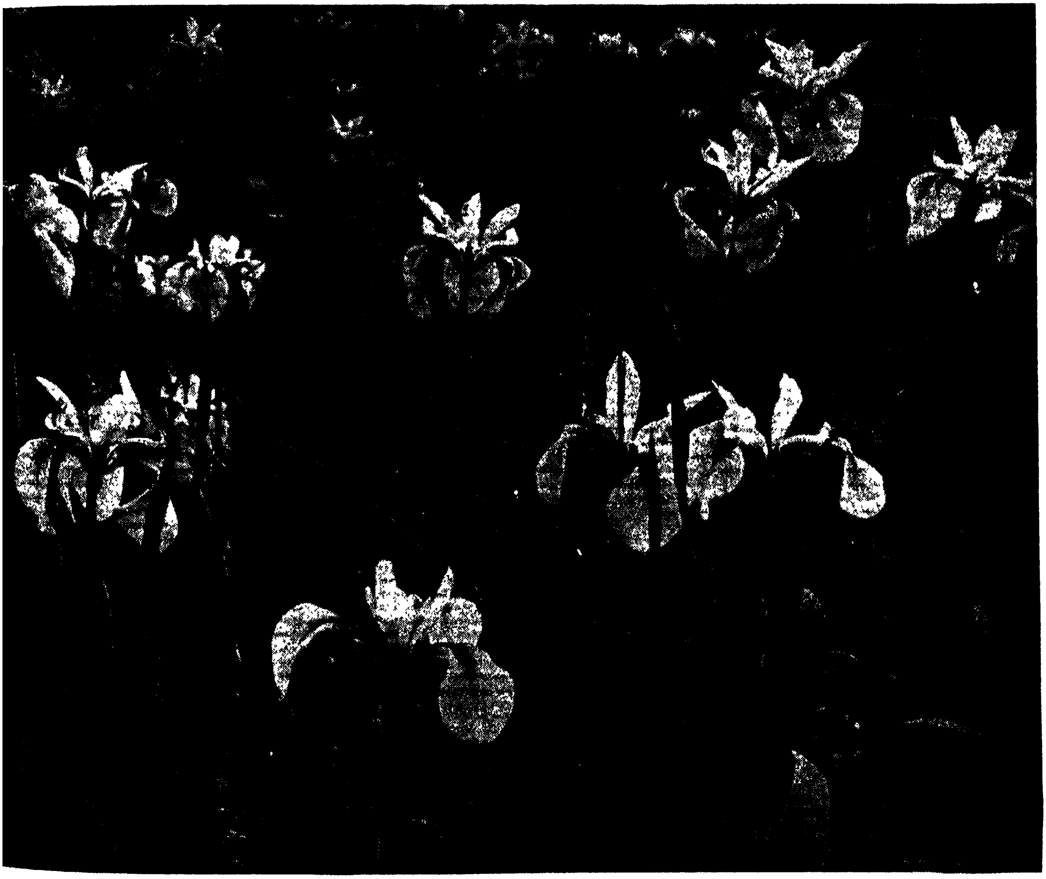
the involucre. The fruit is bright red and berry-like, and lends beauty to the woods and swamps in late summer. The berries are edible, and form part of the winter food of denizens of the northern woods of Canada.

THE REGAL FLEUR-DE-LIS, THE FLOWER OF CHIVALRY

The large blue flag, or fleur-de-lis, is beautiful in form and color. The fleur-de-lis, the "flower of chivalry" chosen by Louis VII as his badge, was the white iris. It is even more regal and beautiful than the blue species. The latter species has a solitary flower from a green spathe, at the end of a long stem. The flower is large and showy, violet-blue, variegated with green, yellow or white, and purple-veined. The perianth consists of three outer recurved divisions, and three inner smaller and erect parts. The three stamens are covered by the three overarching petal-like divisions of the style. The foliage leaves are flat and sword-shaped, green, and are folded into flat clusters at the base. The stem is one to three feet high, stout, angled on one side, and leafy. It abounds in wet meadows and ditches, and the flowers appear in June. The blue flag flower possesses a special interest to the botanist because it is an example of a flower that has guarded itself against self-fertilization. The divisions of the style overarch the stamens, and this arrangement effectually prevents self-pollination. Bees carry pollen from one flower to another. It is said that bees like blue flowers. The insect lights on one of the recurving sepals, and, guided by the conspicuous veins, thrusts his head and back beneath a branch of the style and sips the honey at the base of the stamens. The pollen

may chance on a field of wild blue flags—the long, spear-like leaves seeming to protect the regal flowers.

All pictures except top one on page 6581 from L. W. Brownell



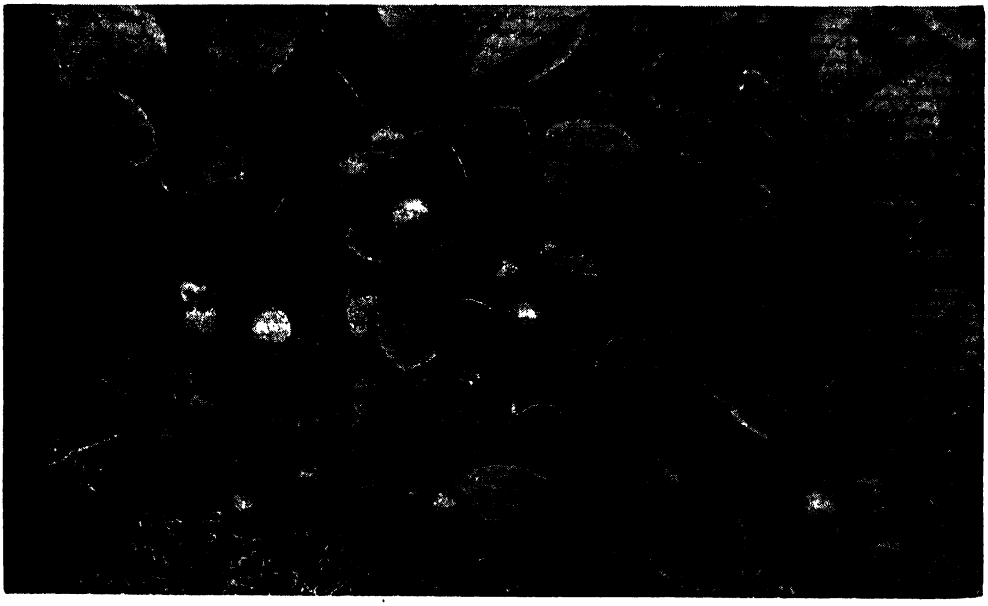
is sifted on his back. In withdrawing he leaves the stigma of that flower untouched, but the projecting lip of the stigma of the next flower visited scrapes his back and thus secures the needed pollen.

The blue-eyed grass blossoms in June, and belongs to the iris family. The plant is about one foot high, with narrow grass-like leaves, and small blue flowers with a yellow center. The flowers open in the morning but close later in the day. This plant is common in meadows from coast to coast.

The fringed polygala is a delicate and lovely flower blossoming in early June. It prefers a sandy soil in rich woods and is found in eastern and middle Canada. The stem is three or four inches high, from long prostrate or underground stems. The upper leaves are green, ovate and crowded at the summit; the lower leaves are scattered and scale-like. The whole plant has a fresh and tender aspect. It has large showy purplish flowers, rarely white, with corollas that are conspicuously fringed and crested. In addition to these showy blossoms the plant bears small hidden flowers on its under-

The five-petaled blossoms of the wild geranium.

Cream-white flowers star the partridgeberry vine.



Food for birds and deer in the winter—the spicy red berries of the wintergreen, which really is a small evergreen. The aromatic leaves give us oil of wintergreen, used in flavoring and in medicine.

ground stems—"one playful flower for the world, another for serious use and posterity."

In June woods the much divided leaf and rounded flower clusters of wild sarsaparilla are often seen, and later in the year the dark berries are noticeable. The stem bears a single large long-petioled and much divided leaf, and a shorter naked scape that bears the rounded flower cluster of small greenish white flowers. The long roots are fragrant and aromatic, and are often sold as a substitute for genuine sarsaparilla.

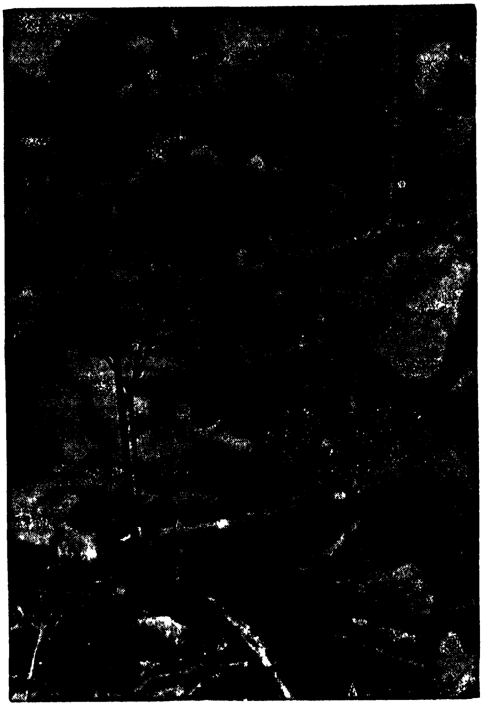
THE GERANIUMS OF THE WOODS

Wild geranium is a common woodland plant flowering in early summer. The stem is erect and from one to two feet high. The leaves are hairy, five-parted, with the divisions lobed and cut. The flowers are quite large, magenta or pale purple, and grow in clusters at the ends of the branches. The corolla is regular, with five petals. The calyx is hairy and has five sepals. The beak-like appearance of the fruit, which splits at maturity so elastically as to discharge the seeds to some distance, gives the common name crane's-bill. *Geranium* is the Greek word for "crane." Our cultivated geraniums are quite different.

Herb Robert is another geranium very similar to the last, but somewhat smaller. Its leaves are smaller and more deeply cleft, and the flowers are coarser in texture. The stem is usually stained with red, and both stem and leaves emit a strong odor when bruised.

The oxalis, or wood sorrel, belongs to the same family. The name sorrel comes from the word "sour," and has reference to the acrid juice of sorrels. The white oxalis makes a dainty carpeting in June woods. The flowers are frail-looking, about one inch broad, with five white petals veined with red, and are solitary on little scapes from two to five inches high. The leaves are divided into three clover-like leaflets that "sleep" at night—that is, they droop and close one against another. The early Italian painters used this flower as a model. Ruskin says: "Fra Angelico's use of the *Oxalis acetosella* is as faithful in representation as touching in feeling. The triple leaf of the plant and white flower stained purple probably gave it strange typical interest among the Christian painters."

By many the three-parted leaf has been considered the shamrock of the ancient Irish, and these people think its leaf was used by St. Patrick in his endeavor to prove to his audience the possibility of a Trinity in unity. The odd name "alleluia," given it in Europe, recognizes its coming near the glad Easter season. The yellow oxalis or yellow wood sorrel, has fragrant bright golden yellow flowers. It is not really a woodland plant but is common along roadsides and in gardens and fields. The stem is leafy and slender, and the blossoms, which open only in the sunshine, are in few-flowered clusters at the end of the stem. After the flowering season little erect pointed pods take the place of the flowers.



Wild sarsaparilla, the shy greenish white flower clusters shaded by the large, divided leaves.

The partridgeberry is an evergreen vine clothed with dark shining rounded green leaves, which are often veined with white. At all times of the year this pretty trailing vine, with its little evergreen leaves, adorns our moist woods and woodside banks.

The little cream-white flowers appear in June and July, and are succeeded later by bright red berries which, though nearly tasteless, are much liked by birds. The unmolested berries remain on until the following spring, when they may be found among the waxy flowers.

The wintergreen, or checkerberry, is a

much prized dainty little evergreen found in the cool shade of evergreen woods. The stem is from three to six inches high, slender and leafy at the summit. The leaves are oval, about one inch broad, sparingly toothed, shining green, evergreen and edible. The delicate little white flowers are urn-shaped, with the corolla five-toothed, and they usually hang in two's on slender peduncles, just beneath the spreading leaves. The flowers are delicate and pretty, with a background of shining leaves. The leaves have a pleasant aromatic flavor similar to that of sweet birch, and are sometimes used as a substitute for tea. The bright red berries are relished by birds and deer during the winter.

The Indian poke, or false hellebore, attracts attention in early spring and summer, not because of its dingy flowers, which appear in June, but because of its tall stems, from two to seven feet high, clothed with many large broadly oval, pointed, clasping leaves. The root is coarse, fibrous and poisonous. The plant grows in swampy woods. It is a low, fleshy herb, from three to eight inches high, without green foliage, but with colorless bracts in place of leaves.

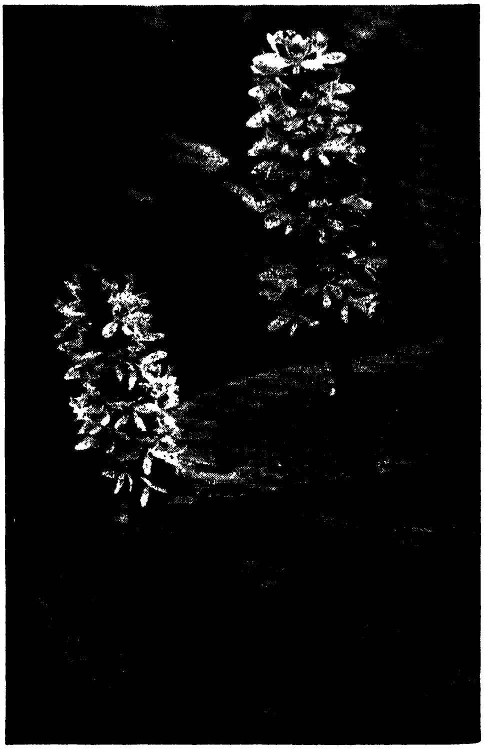
The flower is white or pinkish, single, terminal and nodding—the bowl of the pipe. The plants spring from a ball of matted rootlets which derive their nourishment from decaying vegetable matter. The clammy touch of the plant, its wax-like whiteness in life, and its disposition to decompose and turn black when plucked and handled, make the name corpse plant seem singularly appropriate. The Indians counted it a healing plant and made an eye lotion from it.

BEECHDROPS AND CUCUMBER ROOT

Beechdrops, or cancerroot, is another fleshy parasitic plant of northern woods. These curious-looking plants have slender branching fleshy stems, purplish or yellowish in color, without leaves but covered with small scales. The flowers are purplish or yellowish, small, and of two kinds, the upper being sterile and the lower, fertile. The pine sap, or false beechdrops, is another parasitic plant very similar to the true beech-

Indian poke, or white hellebore, of swampy woods.

The blue spikes of the water-loving pickerelweed.



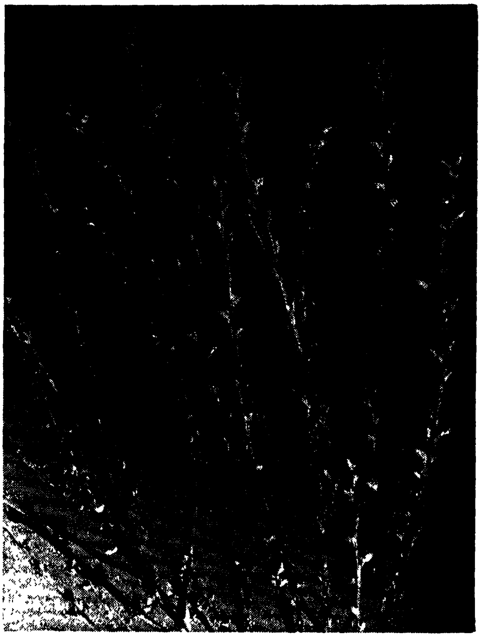
drops, found from June to August in oak or pine woods. It is tawny, reddish or whitish. The flowers are clustered and fragrant.

The Indian cucumber root is found in deep woods. It has a tuberous rootstock, which in shape and flavor resembles a cucumber, and was probably used as food by the Indians. The stem is slender, from one to three feet high, with leaves in two whorls, the lower whorl of from five to nine oblong pointed leaves set close to the stem, the upper whorl of three or four much smaller leaves. The flowers are greenish yellow, small, clustered, and set close to the upper leaves. In September the brilliant foliage and purple berries of the little plant attract attention.

Leaving the forest and approaching the bank of a fresh-water stream or shallow pond, one's attention is attracted by the blue closely spiked flowers of pickerelweed, which blossoms from July to September. The stem is stout and usually one-leaved. The leaf is arrow- or heart-shaped, and clasps the stem about midway, while others on long petioles grow from the rootstock. One may fish for pickerel in the shallow water where pickerelweed grows.

The early French Canadians were so impressed with the beauty of the cardinal flower that they sent the plant to France as a specimen of what the wilds of the New World could produce. In late summer its brilliant red blossom gleams from marshes and moist ground along brooks, from Nova Scotia to Manitoba, and far down into the United States. The stem is from two to four feet high, and hollow. The leaves are alternate, narrowly oblong or lance-shaped, and closely set to the stem. The showy spike is loosely set with bright red flowers. The corolla is somewhat two-lipped, the upper lip of two erect lobes, the lower lip spreading and three-cleft. The flowers are frequently visited by and chiefly pollinated by the ruby-throated humming-bird. The name likens it to the gorgeously attired dignitaries of the Roman Catholic Church.

During the late summer or early fall, if one comes upon a brook or a marsh glowing with this gorgeous flame, he can never forget the sight. No flower of the greenhouse or the garden can surpass these proud plants which swing in the breeze like moving flames among the green.



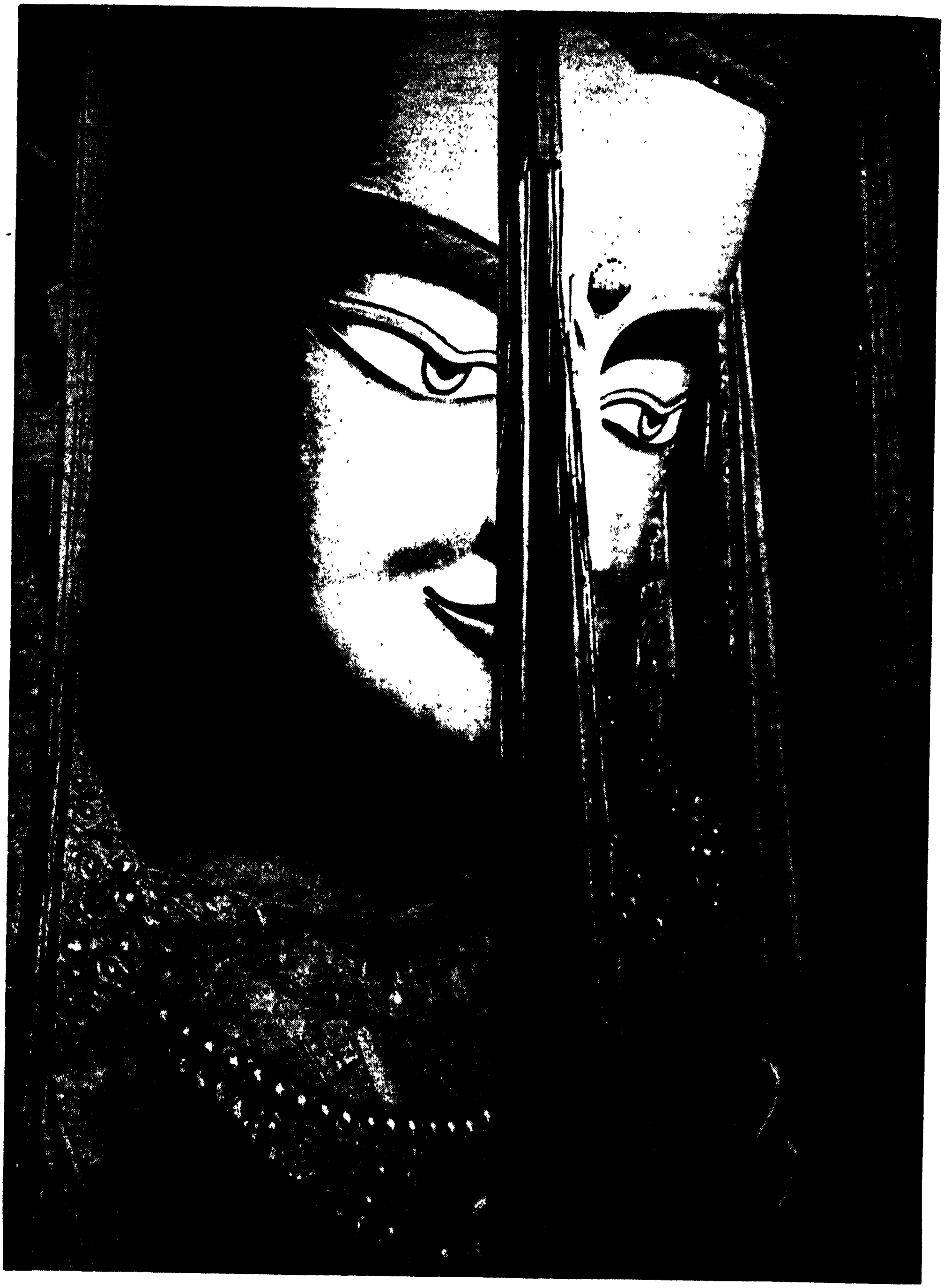
Roche

The leafless but scaly stems of the beechdrops.

Beside a brook—the flame of cardinal flowers.

THE NEXT STORY OF PLANT LIFE IS ON PAGE 6654

THE LARGEST BUDDHA IN TIBET



C. Suydam Cutting

The gilded-wood face of this Buddha, with its wide eyes and dipping eyelids, smiles serenely in a dim tower in Shigatse. The whole figure is about thirty-five feet high; and to take this picture of the face, the photographer had to climb a ladder thirty feet above the floor. Shigatse is Tibet's second largest city.

© Sovfoto

This picture shows three methods of transportation in Mongolia—automobile, camel and pony.

THE HEART OF ASIA

TURKESTAN, MONGOLIA, TIBET, NEPAL, BHUTAN AND AFGHANISTAN

IN the stories of the countries of Europe we often read of fierce conquerors from the centre of Asia who laid waste the lands through which they passed. We know these tribesmen from Asia by the names of Tartars and Huns. Hundreds of years ago the population of Europe was very small; it seemed to persons living then that the Tartars and Huns spread over the land in numbers too great to be counted.

As time went on, these warlike wandering tribes lost their power. Some of them settled in Europe and became less fond of fighting. Many went back to the great uncrowded tract of land from which they or their fathers came. It is this land, as large as the whole of Europe, that men call the Heart of Asia or, less poetically, Central Asia. Included in this region are Turkestan, Mongolia, Tibet and Afghanistan. One sees great mountains in the Heart of Asia—some of the greatest in the world. There are lofty plateaus; there are forbidding deserts; there are grassy plains and fertile valleys.

The march of civilization has been very slow in the Heart of Asia save for a few favored regions. Generally speaking, the inhabitants tend their herds and till the soil to-day as their ancestors did before them. Long caravans of camels, ponies and asses still carry goods from one point to another, toiling over ancient routes from oasis to oasis, across deserts and difficult mountain passes. Within recent years, indeed, automobiles and tractors and trucks have made their appearance and the roar of airplane motors is no longer unknown. Yet these modern machines have not greatly affected the life of the people.

In this article we shall tell you about the regions that make up this fascinating part of the world. Let us begin our survey with picturesque Turkestan.

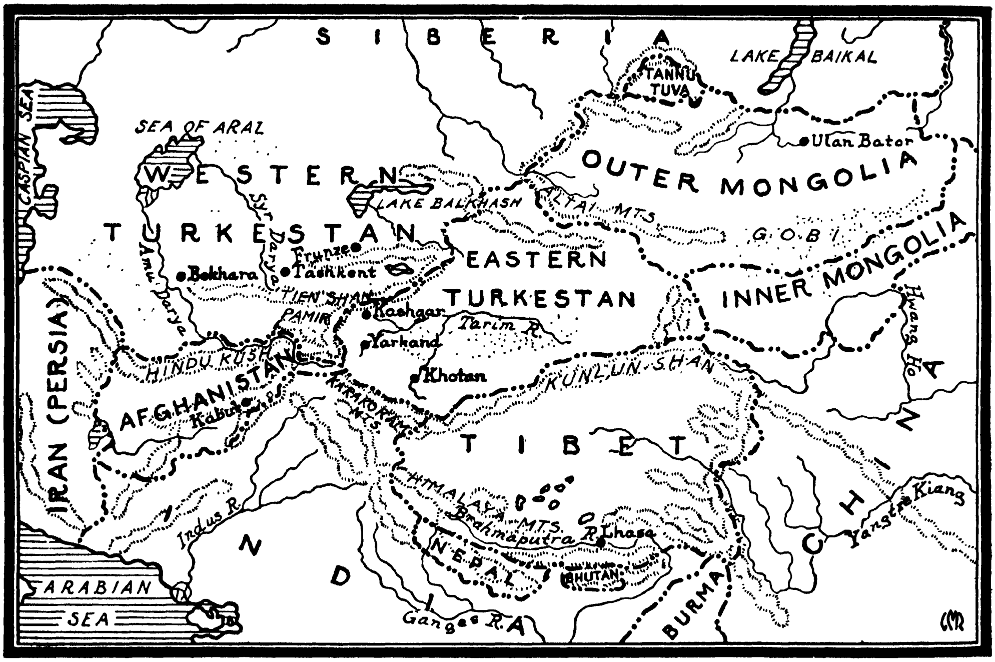
The name Turkestan is applied to a great district in Central Asia bounded on the north by the vast land formerly called Siberia, on the east by Mongolia and China, on the south by India, Afghanistan and Iran, and on the west by the Caspian Sea. Within this area of more than a million square miles there live a score of peoples—Russians, Chinese, Khirgiz, Tajiks, Uzbeks, Turkomans and others. Turkestan has no racial unity; neither has it political unity. It is divided into Western Turkestan, which belongs to Soviet Russia, and Eastern Turkestan, which belongs to China.

Western Turkestan has lofty mountain ranges, broad deserts and grassy steppes (this name is given to the vast plains of Asia and Southeastern Europe). The region is watered by two great rivers, the Syr Darya (*darya* is the Persian word for river) and the Amu Darya, which flow into the inland sea of Aral. The valleys of these rivers and of the smaller rivers of Western Turkestan are very fertile.

Western Turkestan has been the scene of

almost numberless migrations and invasions. It was definitely conquered by Russia in 1865, and since that time it has been a Russian possession. It now forms part of the district called Soviet Central Asia. The northern part of Western Turkestan is included in the Soviet republics of Kazakistan and Kirghizia; in the mountainous southern part we find the three republics of Turkmenistan, Uzbekistan and Tajikistan.

The Soviet Government has brought about considerable changes in Western Turkestan. Millions of acres have been brought under cultivation by means of canals from the Amu Darya, the Syr Darya and other rivers. Electricity, newspapers, the radio, broad highways and a modern railroad (the Turkestan-Siberia Railway) are beginning to bring the backward peoples of the region abreast of the modern world.



The countries in the heart of Asia. The map shows the principal mountain ranges and the great Gobi desert.

Agriculture plays an important part in Western Turkestan; the products include cotton, fruits, vegetables and grain. Sheep raising is also carried on, on a large scale; the sheep of the region are famous for their fine wool. There are large deposits of minerals, including coal, petroleum, sulphur, salt, lead and mica, and these are being worked in increasing quantities. The manufactures include hand-woven rugs, leather, cement, textiles and farm machinery.

The largest city in Western Turkestan is Tashkent, the capital of Uzbekistan; this great commercial centre has a population of 585,000. Samarkand, the former capital of Uzbekistan, is one of the oldest cities in the world; it was very old when it tried unsuccessfully to oppose the armed might of Alexander the Great in the fourth century B.C. To-day Samarkand is a busy market town with 154,000 inhabitants.

Bokhara (population, 75,000), formerly a great centre of Mohammedan learning, also has a flourishing market. Here are sold the famous Bokhara carpets and the fur known as caracul, which comes from the glossy coat of newborn lambs. Other important cities of Western Turkestan are Alma-Atu (population, 230,000), Ashkhabad (population, 125,000), Frunze (population, 93,000) and Stalinabad (population, 83,000).

Eastern Turkestan has been under Chinese rule for a long time; to-day it forms part of the Chinese province of Sinkiang. Some people, indeed, apply the name Sinkiang to Eastern Turkestan. This is not exact, since Sinkiang includes not only Eastern Turkestan but the districts of Kulja and Kashgaria as well.

Eastern Turkestan consists chiefly of a

MOUNTAIN AND PLAIN IN CENTRAL ASIA

The land of Tibet is about one-sixth the size of Australia and is enclosed by the loftiest mountains in the world. It is higher up than any other country of its size. It consists of great plateaus, and the average height of the country is said to be as great as Mont Blanc. This gorge is typical of Tibet.

Away from the mountains, the heart of Asia consists of vast deserts cut up by rivers and dotted with lakes that seem to be disappearing as the deserts extend. This shows the boats used by the people.
Reproduced, by permission, from Dr. Sven Hedin's Scientific Results of a Journey in Central Asia.

dreary plateau, surrounded almost entirely by mountains. A few streams come down from the heights of the Pamir, on the west, and make some farming possible in this barren country. The largest and most important of these streams is the Tarim. After a long and winding course across vast expanses of thirsty sand, the Tarim dwindles away in a series of shallow lakes and salt marshes. The Tarim and its basin were first thoroughly explored and mapped out by the Swedish explorer Sven Anders Hedin (1865-) in the nineteenth century.

It is in the valleys of the Tarim and the other rivers and also in a number of oases scattered throughout Eastern Turkestan that agriculture is carried on. The chief crops are cereals, fruits, vegetables, cotton, tobacco and hemp. There are large flocks of sheep in the region; wool is an important product. The mountains that surround Eastern Turkestan are rich in mineral deposits, but these are not highly developed. Gold has been mined, but not in great quantities.

THE CITIES OF TURKESTAN THAT LIE BURIED UNDER THE SANDS

Formerly there were a number of flourishing cities in Eastern Turkestan. Their remains now lie buried under the ever-shifting masses of sand, to be revealed from time to time to the eager eyes of explorers like Hedin. At present there are but three cities worthy of the name—Yarkand (population, 120,000), Kashgar (population, 62,000) and Khotan (population, 26,000).

Mongolia lies to the east of Turkestan. This immense region, which has an area of about a million square miles, is bounded on the north by Asiatic Russia, on the east by the great region of Manchuria and on the south and west by China. Lofty mountain chains cross the northern part of Mongolia; chief of these is the Altai range, to the northwest. In the east the great Khinghan Mountains shut in a vast grassy plain, where great flocks roam.

THE FORBIDDING GOBI DESERT THAT STRETCHES ACROSS MONGOLIA

In the central part of Mongolia there is one of the most forbidding areas in the world—the Gobi Desert. The Gobi (or Shamo, as it is sometimes called) covers nearly a fourth of all Mongolia. It is a treeless plateau, with shifting areas of yellow sand, gravel plains and steppes, covered with a meager growth of wiry grass. Rain falls seldom; howling winds are almost never absent and sandstorms are frequent. The Gobi has yielded up many fascinating secrets of ages long past to the American scientist Roy Chapman Andrews and other fearless explorers. Remains of prehistoric animals and relics of early men have been found.

THE YENISEI RIVER WHICH FLOWS NORTHWARD INTO THE ARCTIC CIRCLE

Most of Mongolia's rivers are to be found in the northwest and south. In the north there is the great Yenisei, which flows through Asiatic Russia after leaving Mongolia and finally empties into the distant Arctic Ocean. In the south the Hwang Ho or Yellow River enters Mongolia from the south, makes a great semicircle and leaves the region again, to flow through China's boundless plains. A number of Mongolian rivers enter lakes that have no outlet.

From very ancient times the Mongolians have been renowned as herdsmen. They have been irresistible warriors, too, when great leaders arose. You have all heard of the Huns, a branch of the Mongolians, who scattered fear and terror in the fifth century throughout Western Europe under the famous Attila. Eight hundred years later, under Jenghiz Khan, the Mongols conquered not only all of Central Asia but China as well. Other Mongolian leaders led their hosts to victory in Russia and India. However, Mongolia's day of power has long been over.

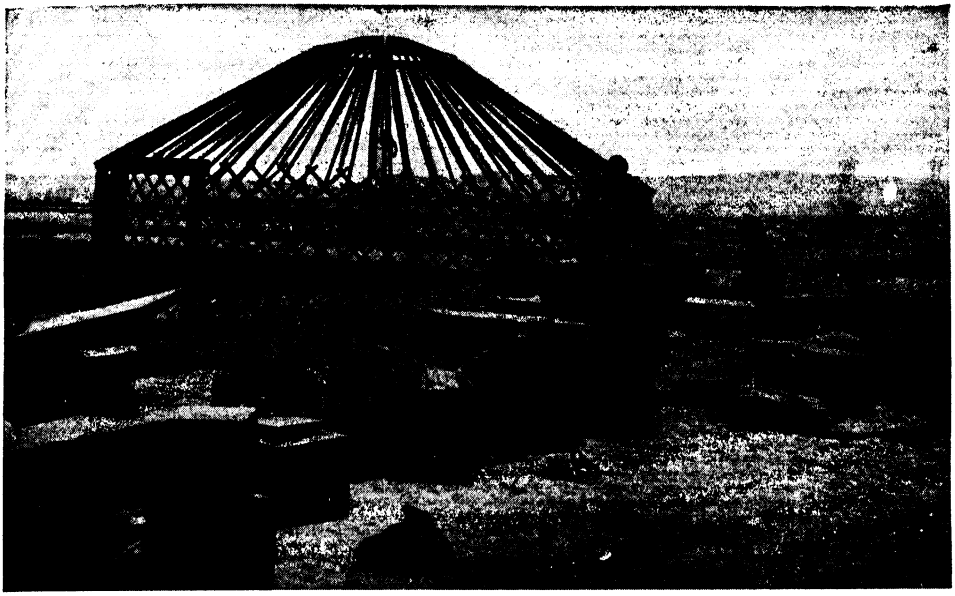
OUTER MONGOLIA AND TANNU-TUVA FOLLOW THE SOVIET WAY

Today Mongolia is divided up into several states. In the north there are the large republic of Outer Mongolia, known officially as the Outer Mongolian People's Republic, and the tiny state of Tannu-Tuva, now officially known as the Tuvinian Autonomous Region. Tannu-Tuva became a part of the Soviet Union in 1945. Less than 100,000 people live in the Region. They are mostly farmers, cattlemen and miners. Their chief exports are hair, hides and wool.

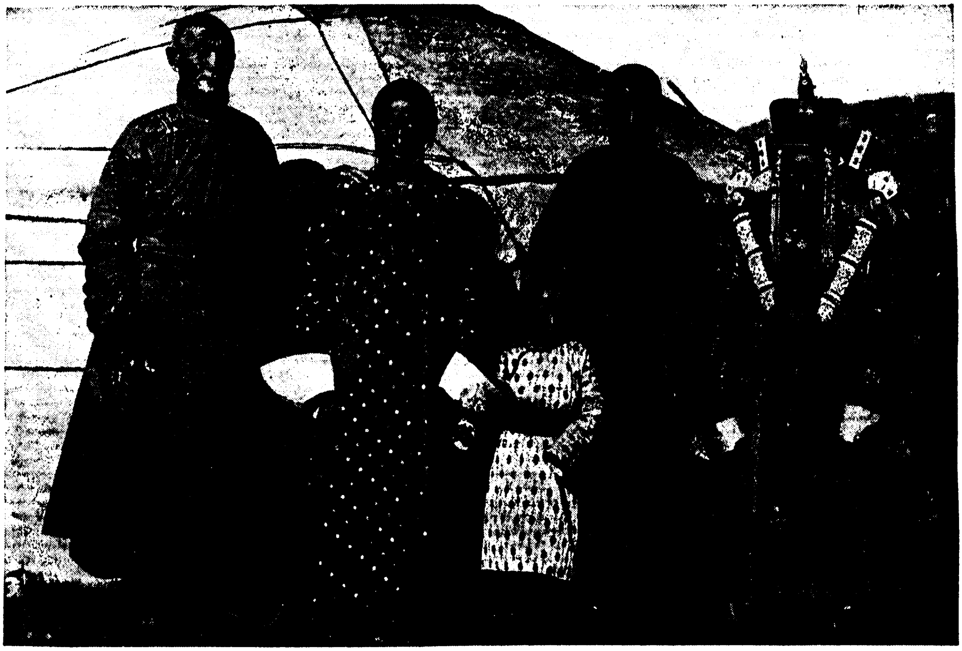
Outer Mongolia has an area of 620,000 square miles and a population of about 675,000. The 65,000 inhabitants of Tannu-Tuva live in an area of 64,000 square miles. Russia gets most of the exports of the two countries; they send her their hides, furs, camel's hair, mutton and beef. Certain industries have been introduced under Russian influence, especially shoe factories and tanneries. Some coal and gold are mined, particularly in the Altai region, which is rich in metals.

The city of Ulan Bator Khoto (formerly called Urga) is the capital of Outer Mon-

THE PEOPLE WHO LIVE IN CENTRAL ASIA



Many of the people of Central Asia are nomads—herdsmen of no fixed abode who carry their homes with them, as their livestock and the pasture conditions may require. The picture above gives an idea of how a nomad homestead—a "yurt"—is constructed. Heavy felt or skins are tied down over the lattice-work with thongs. In the foreground are the boxes and crates in which the family possessions are transported on the back of pack animals and—sometimes—in automobiles. Note the soldier in a uniform resembling the Russian at the right. Russian influence is strong in Outer Mongolia, where the picture was taken.



Sovfoto

Most of the people of Central Asia eke out a bare existence from the arid land; but not all nomads are poor. Here we have a well-to-do Mongol family in front of its yurt. From left to right there are Sandja, head of the family; his wife Chulun; their son Puntsok and his 18-year-old wife Tsirma; and their 3-year-old granddaughter Bimba. The elaborately ornamented ceremonial headdress has descended from Chulun to Tsirma. The "ram's horns" are made from her own hair, stiffly waxed and plaited. Note the fine quality of the dress materials, the curious shoes and the long sleeves, almost covering the hands.

golia; it has a population of about 100,000 inhabitants. Kysylchoto (called Krasny in Russian), on the Yenisei River, is the capital of Tannu-Tuva; it has only 10,000 inhabitants. This is also written Kylsyl Khoto.

MONGOLIA WAS THE HOME OF THE GREAT GENGHIS KHAN

Outer Mongolia shares the Gobi with Inner Mongolia, its neighbor to the south. Inner Mongolia covers only 200,000 square miles, and its population is less than that of New York or London; estimates run between 3,000,000 and 7,000,000. Once the two Mongolias were united, and they have had an astonishing past, for Mongolia was the home of the great Genghis Khan and other Mongol warriors feared from the Yellow Sea almost to the Baltic. Their glory departed, and Mongolia was ruled for two centuries by the Russians, then by the Chinese. In 1912, when Outer Mongolia declared its independence, Inner Mongolia remained with China. It was overcome by the Japanese in the 1930's, and a puppet state, called Meng Chiang, was set up, with a descendant of Genghis Khan as puppet ruler. After the war, the state became communist.

The Mongol element in the three states that make up Mongolia is still very numerous. A large proportion of the Mongols are nomads, who roam with their great herds of cattle and sheep and goats over the steppes. They live in movable huts, called *yurts,* which are covered with felt. They generally use camels to carry their loads and draw their carts; they ride on wiry ponies. In religion the Mongols are almost all followers of Lamaism, a form of Buddhism.

THE LOFTY TABLELAND WHERE THE TIBETANS LIVE

The chief stronghold of Lamaism is the extraordinary country of Tibet. It consists for the most part of a vast plateau, extending eastward from the Pamir region, between the Kunlun mountains to the north and the Himalayas to the south. This plateau is the loftiest in the world; it averages some 15,000 feet above sea level. Here and there mountains rear their lofty heads from the tableland. There are ridges extending from the Karakoram range in the west and from the Kunlun in the north; in the east there are several parallel ranges.

The tablelands of the north and west are treeless; they abound in grassy steppes and salt lakes. The climate in these tablelands is stern and forbidding. The summers are short but terribly hot; the winters are extremely cold. Fertile land is to be found only in the valleys of the eastern and southern rivers. Several mighty streams have their headwaters in Tibet. In the east there are the Yangtze Kiang, the Hwang Ho and the Salween (or Salwin); in the southwest, the Indus. The Brahmaputra also rises in the extreme southwest of the country and carves a way for itself through Tibet from west to east until at last it enters India. It is interesting to note that the beds of nearly all the rivers of Tibet are at least several thousand feet above sea level.

The Tibetans are a Mongolian people, related to the Chinese in race and language. For many centuries, indeed, Tibet has been considered by China as an outpost of her territories; until 1911 Chinese garrisons were maintained in the country. In that year, when a great revolution broke out in China, the Tibetans seized their chance and drove out the Chinese garrisons. Since that time the people have not permitted Chinese soldiers to enter again. China still claims sovereignty over Tibet, but has not been able to enforce her rule.

TIBET WAS CLOSED TO EUROPEANS FOR MANY CENTURIES

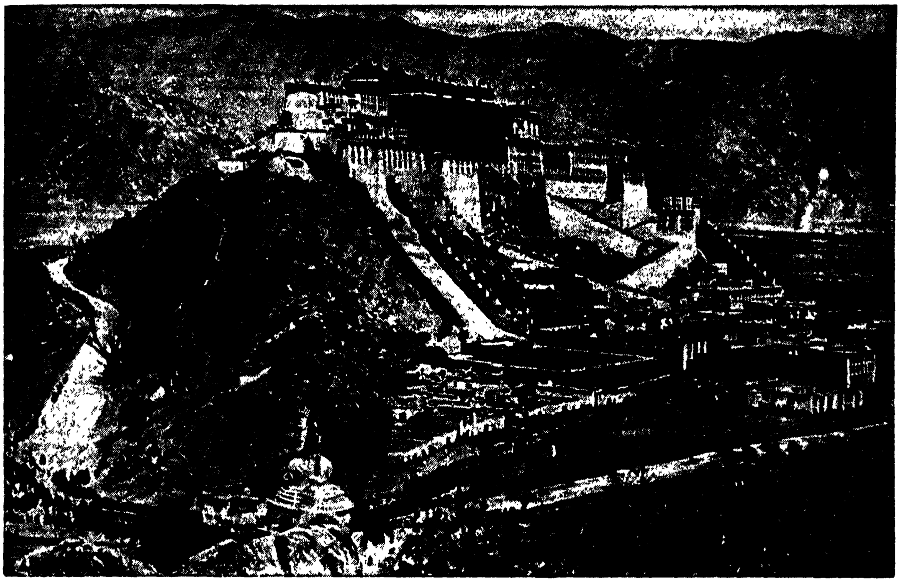
Until the present century Tibet was almost entirely closed to Europeans, for the Tibetans disliked and distrusted foreigners. In 1904, however, a British expedition entered the capital city of Lhasa by force and compelled the Tibetans to sign a trade treaty with England. Trade relations between Tibet and India have grown considerably of late years.

There are few countries where religion plays so important a part in the lives of the people. A large part of the population—perhaps as much as a fifth—are lamas or priests. Two lamas are supreme rulers in government and religion. The chief ruler is called the Dalai Lama, or Grand Lama. He shares his power with the Tashi Lama, who is chiefly interested in religious matters.

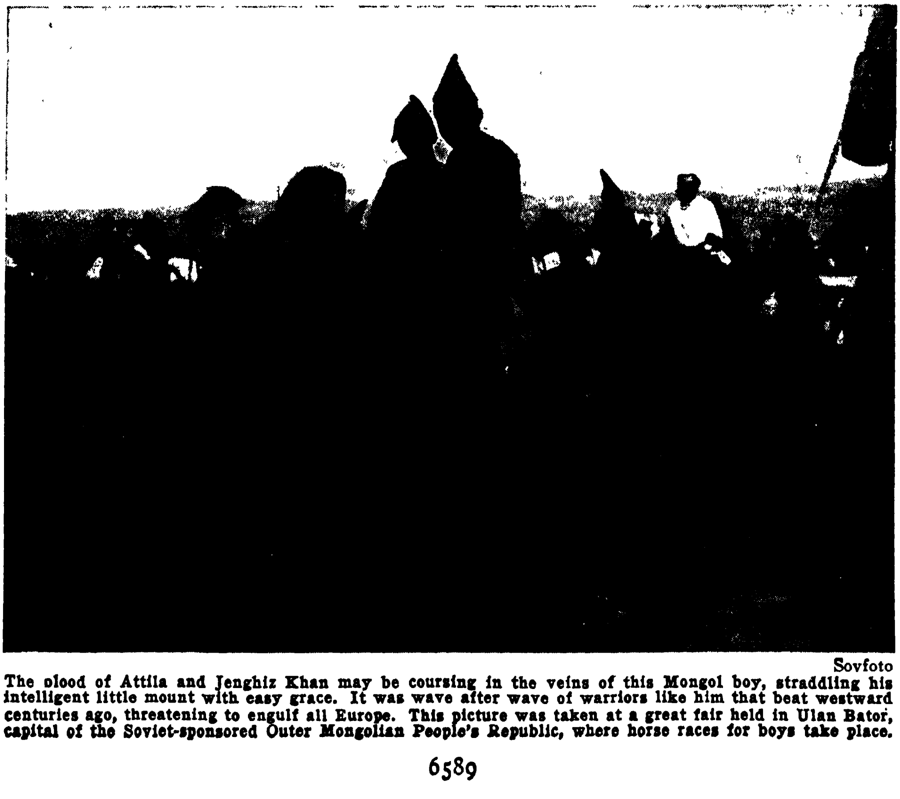
THE TIBETANS' STRANGE BELIEF ABOUT THEIR DALAI (GRAND) LAMA

The Tibetans believe that the soul of a dying man can continue its existence within a new body. When the Grand Lama dies, his soul is supposed to pass into the body of a child born at the exact moment when the Dalai Lama stopped breathing. When this child is found, he becomes the next Grand Lama. The present Dalai Lama is a peasant boy, born on December 17, 1933. He will not take up all the duties of his post

TEMPLES AND WARRIORS IN ASIA'S HEART



Not so many years ago no such photograph as this existed; for foreigners were not admitted to Lhasa, which means "Home of the Gods," and which is the capital of Tibet. The Potala, shown above, dominates the city. It is a lama monastery and a fort, and in the centre is the great red palace of the Dalai Lama with its gilded rooftops.



Sovfoto

The blood of Attila and Jenghiz Khan may be coursing in the veins of this Mongol boy, straddling his intelligent little mount with easy grace. It was wave after wave of warriors like him that beat westward centuries ago, threatening to engulf all Europe. This picture was taken at a great fair held in Ulan Bator, capital of the Soviet-sponsored Outer Mongolian People's Republic, where horse races for boys take place.

until he is eighteen; in the meantime another lama is acting as regent.

is the capital, Lhasa, which has a population of about 50,000 inhabitants.

is wielded by the prime minister, who is chosen from the ruling family. A British envoy, with a small escort of Indian soldiers, lives at the capital. He influences the foreign policy of Nepal, but does not interfere in domestic affairs.

Bhutan, a tiny kingdom with an area of 18,000 square miles and a population estimated at 300,000, originally included much territory that now forms part of British India. At present, as in Nepal, the British help decide the foreign policy of Bhutan but do not interfere otherwise. Formerly the country was ruled jointly by two men, one representing the priestly class, the other the people. There is now a single supreme ruler, the maharaja.

Like Nepal, Bhutan is mountainous, with a gradual downward slope from north to south. The inhabitants are a hardy and vigorous race, of Tibetan stock. Their language is a dialect of Tibetan; their religion, like that of Tibet, is Lamaism. Some parts of Bhutan are very fertile and rice, wheat, corn, mustard and buckwheat are grown in considerable quantities. The winter capital of the country is Punaka (or Punakha), a strong natural fortress; the summer capital is Trashichödzong (also written Tashi-Cho-Dzong).

THE COUNTRY OF AFGHANISTAN PROTECTED BY MOUNTAINS AND DESERT

The last region of Central Asia that we are to discuss in this chapter is the independent kingdom of Afghanistan. It is guarded from the outer world by a series of natural barriers. On the north there is the southern desert of Western Turkestan and the Amu Darya; on the east there are the Suliman and Gondan ranges. Desert country shuts off Afghanistan from British-controlled Baluchistan to the south and Iran (Persia) to the west.

The country is very mountainous. It is crossed from east to west by the Hindu Kush chain; there are other great ranges in many different parts of the country. The rivers of Afghanistan are numerous; among them are the Amu Darya, the Murghab, the Hari Rud, the Kabul and the Lore. The climate varies greatly in different parts of the country. In the desert lands to the south and west the heat is very great; the cold is severe in the highlands. There is little rainfall in Afghanistan, even during the rainy season.

The people of Afghanistan claim that they are of Jewish origin. Some of their writers say that the Afghans are descended from Afghana, the grandson of the Jewish king Saul; others maintain that the inhabitants of the country are the descendants of Jewish prisoners sent into the Afghan mountains by Nebuchadnezzar. Whatever their origin may be, the Afghans of to-day show many different racial strains. There are peoples of Turkish blood in the basin of the Amu Darya and along the Indian frontier. Other Afghans show strains of Persian and Mongolian ancestry. The fiercest warriors are the Pathans, who live partly in Afghanistan and partly in Northwest India. Most of the Afghans belong to the Sunnite sect of Mohammedans.

These different races have never formed a united people, except when they combine to fight an invader. There is hostility between the various races, sometimes between clans or families belonging to the same race. This hostility often bursts into violence; feuds are sometimes carried on for many generations. As a result of this constant fighting, the Afghans are a warlike people.

In spite of their bravery, however, the Afghans had to submit in the past to many different races of conquerors. Macedonians, Arabs, Turks and Mongols swept across the land in turn. The Afghans did not win their independence until the middle of the eighteenth century.

LORD ROBERTS' FAMOUS MARCH FROM KABUL TO KANDAHAR

The English, who wished to extend their influence in Afghanistan, fought two wars with that country in the nineteenth century. The first (1838-42) was marked by a terrible massacre of the English troops in January, 1842, in the Khyber Pass, between Afghanistan and British India. In the course of the second war (1878-80) Lord Roberts made a famous march of 313 miles in 22 days from Kabul to Kandahar, in August, 1880, in order to rescue a British force besieged in Kandahar.

The Afghans were decisively defeated in this second war and had to sue for peace. English influence in the country was fairly strong for many years thereafter. After World War I, however, the Afghans asserted their complete independence of all foreign powers, and they have jealously maintained this independence ever since. The government of Afghanistan is a constitutional monarchy; the supreme power is shared by the king, the Senate and the National Assembly. The members of the Senate are named by

© Ewing Galloway, N. Y.

Winnowing wheat in Afghanistan by tossing the grain and letting the wind blow away the chaff.

the king; the National Assembly is elected by the people.

Though so much of the country is mountainous, the river basins are often very fertile; many plains have been made fertile, too, by irrigation systems. Agriculture is carried on extensively. Sugar-cane is grown in the plains, and cotton in the warmer parts of the country. Tobacco is widely cultivated and exported to Russia and India. Other crops include wheat, barley, millet and fruits.

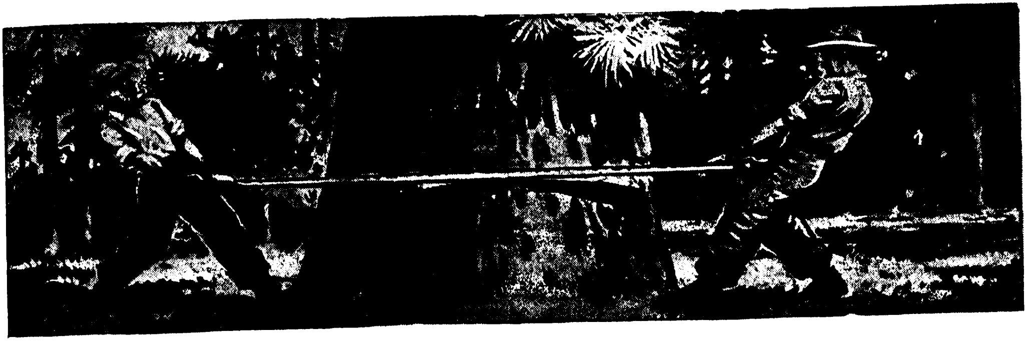
Herding is important; cattle, camels and sheep graze on the pasture lands. The sheep are of the fat-tailed variety. The Afghans use the fat in the tails as a substitute for butter. The wool and skins of these sheep provide material for warm clothing; their mutton is a favorite food.

Afghanistan is generally supposed to be rich in minerals, but the mineral deposits are largely unexplored. Coal, lead, nitre, sulphur, gold and silver are mined, but the production is comparatively small. The lapis lazuli and balas rubies of Afghanistan have a world-wide reputation; the deposits, however, have not been worked regularly. One of the chief difficulties in developing the mining properties of the country is the matter of transportation. There are no railroads in the country; hence the products of the mines must be carried on pack animals along steep mountain trails.

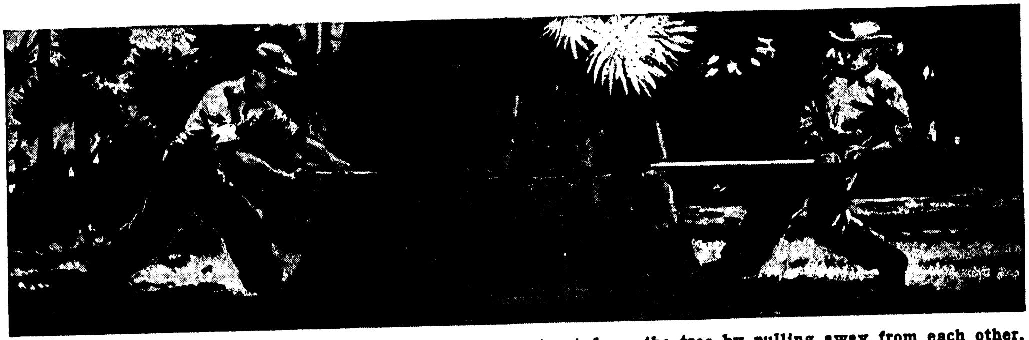
The carpets marketed in the city of Herat are famous; they are often sold in America as "Persian" carpets. They are soft, brilliant in color and very durable. Of late years a number of Western industries have been introduced in the country. There are manufactures of matches, buttons, leather goods, furniture, woolen fabrics and clothing, but these are still on a rather small scale.

The area of Afghanistan is about 250,000 square miles; the population is estimated at about ten millions. The largest city, Kabul, which is the capital, has some 80,000 inhabitants. Other important towns include Kandahar (population, 80,000), Herat (population, 50,000) and Mazar-i-Sharif (population, 30,000).

THE NEXT STORY OF ALL COUNTRIES IS ON PAGE 6668.



CO-OPERATION



No matter how long or how hard they try, the men can not cut down the tree by pulling away from each other. But when they work together, each one pulling in his turn, the job is soon done.

CO-OPERATION is a live word, an active word. It means "working together." Without co-operation our very homes, our schools, our churches, society itself, could not exist. Without a good measure of it there could be neither government, business nor community life.

Our forefathers knew its meaning well in the village communities that made up their life for thousands of years and in the frontier settlements of early America. It brought success to the European guild system that bound together merchants, master workmen and ordinary craftsmen in their work, their leisure and their community life. Even today some peoples, such as the Zuñi Indians of New Mexico and Arizona, the Chinese and, in many ways, the people of Denmark make co-operation a foundation-stone of daily living.

In the teeming life of our modern cities, and to a lesser extent also on our farms today, co-operation has apparently come to be overshadowed by individual enterprise and competition. But we need only look at the working of any large business concern, or of a labor union, or of the manufacturers' association of our own home town, to realize that even today we can not exist without a considerable measure of co-operation.

Spelled "team work" it expresses a combination of individual effort, fair play and working for a common goal, most easily understood by every boy and girl. Spelled "world community" it awakens the hope that this world of ours can still be made a place in which all peoples can live and work happily together—this new world in which London and Moscow and Chungking are only a few hours journey from one another by airplane; this new world which can be spanned by radio in the fraction of a second.

Co-operation, as we have seen, means "working together." It stands for the sort of effort in which each one of us plays an important part. A player on a school baseball or football team may not be a star, but he is an important member of the team if he works for its good instead of for his personal glory. He is important when he hits a sacrifice bunt and advances a runner from first to second base; he is important when he takes out a would-be tackler and thus makes possible a touchdown run. Just so, in the life of the community and in the business of making a living, co-operation demands that each one should make the most of himself not for the sake of personal advancement but for the good of the community as a whole. The reward of effort in a co-operative spirit is richer because there is more to share and there are more to share it. In fact it is the very heart of free enterprise and the democratic way of life.

Co-operation may mean any free association between two or more persons or groups or communities working together toward a desired goal, in a way they have agreed upon. The word has also come to mean a particular kind of business activity; in this, people organize and own and control the business themselves in a kind of mutual self-help.

It may help us to understand co-operation better if we remember that there is always in the world about us a natural kind of "working together." We may not have planned it, and we may even be unconscious of it, yet without it none of us could live at all.

Even in nature there is a "web of life" that binds individuals and kinds together. Swarms, flocks and herds instinctively stay together for mutual protection and support. Ants protect the aphids that in turn provide them with honeydew. Pilot fish and sharks are said by sailors to "work together." Many animals post lookouts that give alarm signals when danger approaches. Among horses on the steppes leading males will take a key fighting position to protect their herd against attacking wolves. In the beehive and among some of the ants and wasps there is a division of labor and a co-operation so marvelous

Courtesy, National Life Insurance Company

The entire community helped with old-fashioned Vermont "barn-raisings," and many hands made the work light.

Courtesy, Greenwich House, New York

Beautiful music is the result of co-operation among these children.

that it is almost the envy of men.

In the life of men, too, there is much co-operation that is scarcely at all the result of conscious planning.

The most primitive men of whom we have any knowledge were always banded together in some kind of family or horde and later in a tribe for protection against weather, wild beasts, human enemies or hunger. Among "primitive" peoples today some will be hunting or fishing while others gather roots or berries or scratch the soil in rude agriculture, and still others care for the children. Yet all work together to provide a living, to protect their kind, to win the favor of their gods. And those who break the ranks, who refuse to co-operate, will, as a rule, be severely punished.

Our own forefathers live in agricultural village communities. Here each family had its own strips of land, its own cattle and its own harvest; but the families worked their fields together, and herded their cattle and sheep or goats in common pastures. Their woodlots were open freely to all, and their strips of land were reallotted from time to time so that all had an equal chance at the favored plots of ground. They lived by common rules; they all rushed to put out the fire in their neighbor's thatched cottage; they played and sang and danced together on the village square; they worshiped in the common church, and when they died their bones were laid to rest in the ancestral "God's acre."

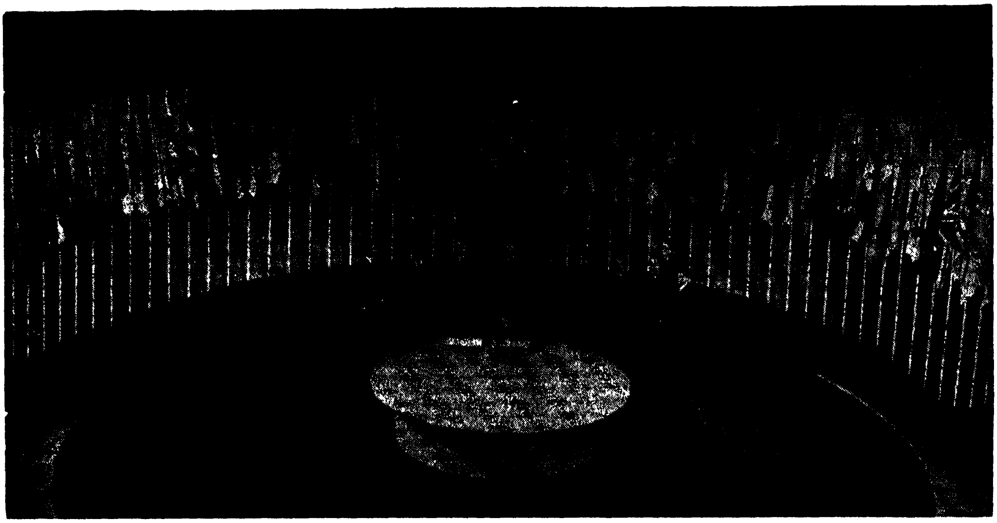
Today our villages have grown into towns and cities, with thousands, sometimes even millions of people. Our neighbors are so many that we do not even know most of them. Instead of an occasional mill or smithy we have a complicated network of factories and market-places, of railroads that cross whole continents and ocean liners that tie continents together. Air transports slip over Greenland or the North Pole to deliver their cargoes in what was once faraway China or Siberia.

However, there still is co-operation between factory and field, between the cotton grower, the mill and the Main Street store, between the busy fruit grower in California and the man who eats his breakfast in New York or Boston or Montreal. There is co-operation, too, between factory owner and engineer and worker, between manufacturer and banker and our local merchant.

But because most of our neighbors are so far away and our village community has really become a whole world community, we have lost something of the old sense of living in a neighborhood. Yet co-operation is even more necessary than in the old days. Modern business is an exchange of services among neighbors; trade is still an exchange of goods among neighbors.

Today our whole world is rapidly becoming one vast neighborhood again. Men are awakening anew to the meaning of co-operation as a conscious, forward-looking program, and to the needs and opportunities for co-operation in every realm both of our national life and of our larger world community.

Let us look now at a number of ways in which such co-operation has already been



Acme photograph

Hope for an era of peace through co-operation. Signing the United Nations Charter at San Francisco.

tried with marked success and with greater promise for the future.

Such co-operation may be seen at its simple best among farmers and fruit-growers in dry country, where fields must be irrigated. Crops can not be grown without water. Water can not be brought to the fields without tapping the stream up the valley. Expensive dams, waterways and water gates must be built, and ditches must be run through the fields of A, B, C and D. If each tried to tap the stream himself, or if A or B up the valley refused to allow water to be run through their waterways to the fields of C and D down the valley, or if A took all the water for himself when there was little of it, those farther down the valley would lose their crops and farming generally would become impossible. By co-operation they have learned to make the desert blossom like the rose.

In industry we are fast learning that over-

Courtesy, Pan-American Union

The patio of the Pan-American Building, Washington, D. C. Twenty-one American republics work together in this union.

work or underpay and poor conditions of work make for poor workmanship and therefore loss to the employer as well as poor living for the worker. And when workers unite to get equal bargaining power with their employer, expensive strikes and lockouts and loss of time and great bitterness may threaten ruin to both employer and workers. But if the two sides come together and talk it over, they often find that half of their wrongs have grown out of their fear one of another, and half of the rest are not really wrongs but hardships neither side can do much to avoid, while the remainder can best be adjusted by shop committees and other expressions of mutual confidence and co-operation. In fact, labor unions and trade associations may in this way themselves become instruments of co-operation between worker and employer instead of co-operative weapons of industrial warfare.

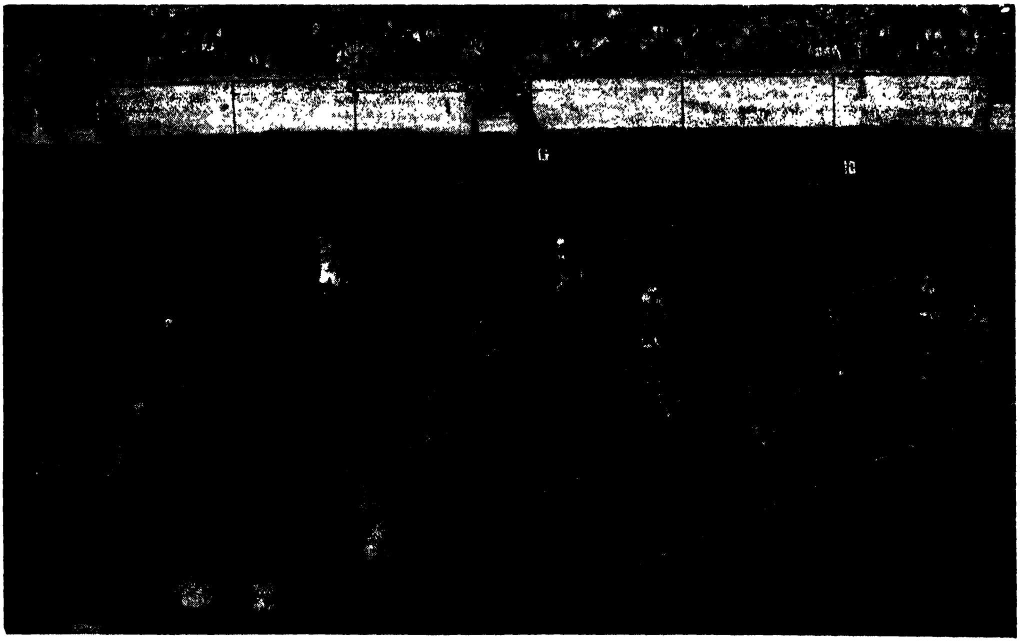
Every city has many agencies to help the underprivileged, to provide leisure-time activities (such as the "Y" or the Scouts' camps) and to look after the health of the community. If all go their own way there will be costly rivalries and overlapping and waste of the community's money, while many important things are left undone. In most cities now, such agencies have learned to join hands in community chests and councils of social agencies, and the whole community is better served. This is community co-operation.

And so with our churches, our schools, the work of the Red Cross, the work of scientific research, of farm and home improvement. In all of these we are rapidly learning the lessons of co-operation, some with government aid and some without it; some merely in the local community and some throughout the whole nation and throughout the world—and the life of our communities is being made the richer by it.

World War I, and the far more destructive World War II, and in between them the great depression, have driven home the lesson that between nations, also, there must be co-operation if we are not all to be destroyed by war. Many hopeful beginnings have been made.

In 1920, shortly after the close of the first World War, there came into being a League of Nations, with headquarters at Geneva, Switzerland. This was perhaps the most promising experiment in world-wide co-operation ever tried. Though it was unable to prevent the outbreak of World War II, it accomplished many fine things.

Under the League there was a Permanent Court of International Justice, with fifteen judges representing many nations, sitting in



Courtesy, Yale University Athletic Association

Every man on a football team is not a star, but each man has his part to play in the game. One player may carry the ball, but the other ten must co-operate in clearing the opposition from his path. Team work brings touchdowns.

court at The Hague in Holland, to settle disputes in the meaning of treaties between nations, and to interpret international law. The United States took part in this court.

Affiliated with the League was the International Labor Office with headquarters at Geneva. This organization accomplished great things in the creating of better standards of labor, the study of immigration, the promoting of safety and health work; also in opposing child labor, and in many other ways. It brought labor groups together in peaceful co-operation.

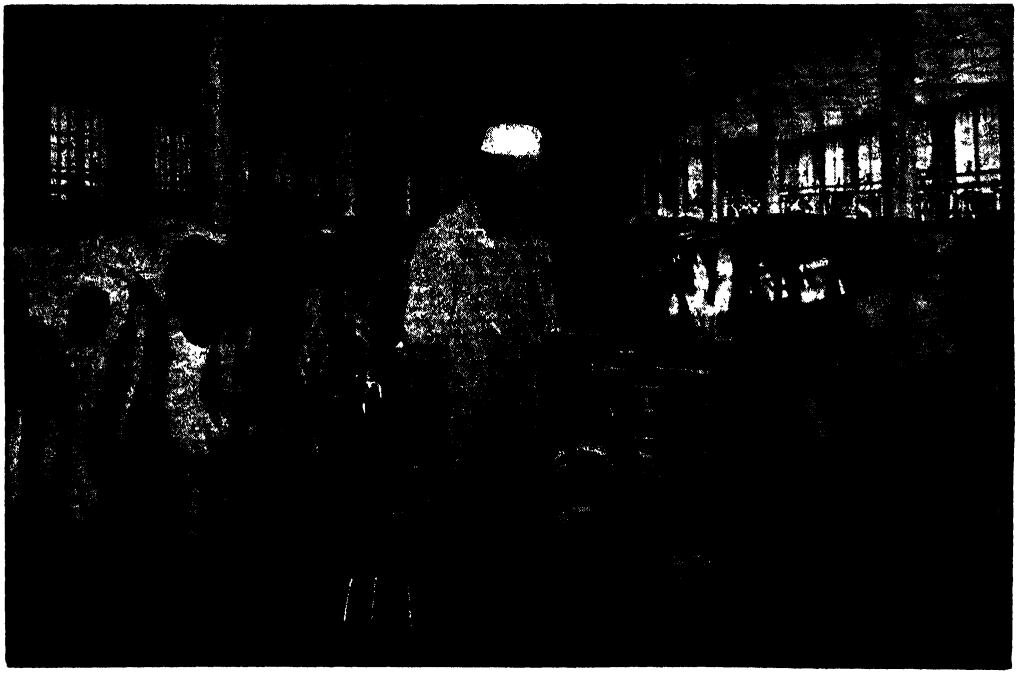
On page 6132 we tell you of a fresh attempt to bring the people of the earth together in peaceful co-operation, under the heading, The United Nations. All men of good will hope that this new union may succeed where the League of Nations failed. Certainly the world has learned that the old ways of settling disputes between countries will no longer serve mankind, but only destroy it. Co-operation is more difficult than dissension, but the time seems to have come when the difficult lesson will have to be learned.

As early as the year 1910, there was set up the Carnegie Endowment for International Peace, "to hasten the abolition of international war" and to promote co-operation between nations through scientific research, through the holding of meetings and through education.

One of its divisions is the Institute of International Education, with headquarters in New York City. This institute helps in the interchange of both students and teachers between the United States and other countries the world over. By studying and teaching and living together, many people, especially young people from many countries, begin to understand each other better and then go home and work for international understanding and co-operation.

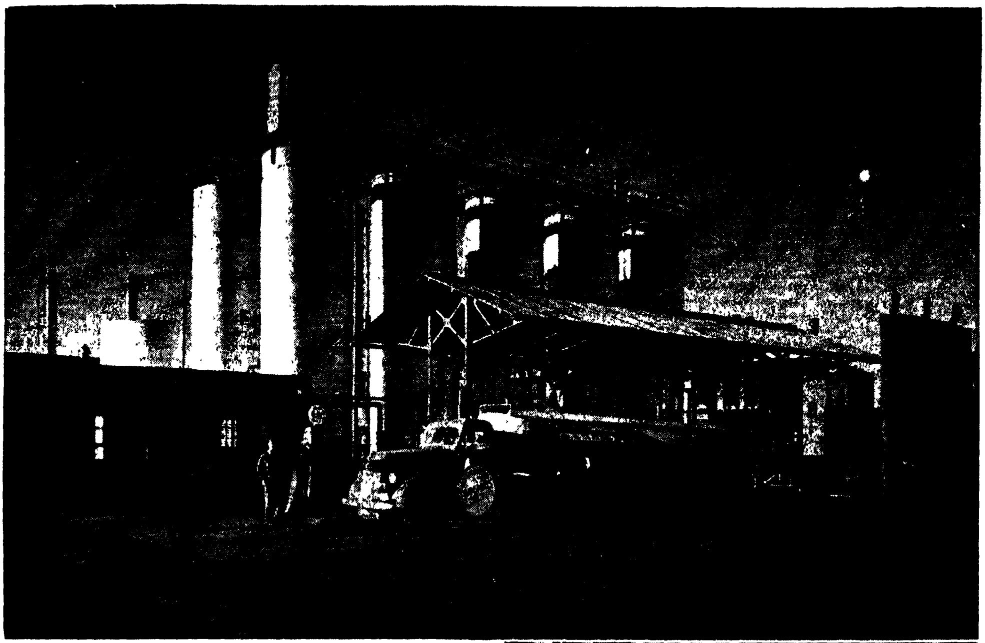
For several years the United States Department of State at Washington, D. C., and the National Educational Association, a voluntary organization, have joined hands in a number of practical ways with similar agencies in other countries in matters of educational co-operation. This is pointing the way to an International Education Office.

Except when war interferes, tens of billions of pieces of mail are delivered all over the world every year without interference of national boundary lines. This is made possible by the co-operation of nearly all countries of the world in the International or Universal Postal Union which has operated successfully since the first international



Co-op League photo, by R. Wurts

Dairymen may combine in a producers' co-operative to reduce operating costs and market their milk at higher prices.



A co-operative oil refinery at McPherson, Kansas. It is owned and run by a large group of farmers, who are thus able to save money in getting the oil they need.

postal convention was agreed upon by twenty-one nations at Berne, Switzerland, in 1874. In this convention the twenty-one countries agreed to consider themselves a single territory for purposes of mail delivery. Any differences or disputes between nations in the matter of mail service are adjusted through this Postal Union.

No greater honor can come to anyone in the field of sports than an Olympic championship. The Olympic Games are a form of international co-operation in sports. For over a thousand years such contests were held every four years in ancient Greece, and if any of the Greek peoples were at war, an armistice was called for the duration of the games. In 1896 this idea was revived in Athens, and since then there has been worldwide participation in these modern Olympic Games. They have been held every four years except in 1916 and again in 1940 and 1944 when war interfered. One of the chief aims of such sports events is to build understanding and good will among the nations.

Another splendid example of international co-operation is the Pan-American Union with headquarters in Washington, D. C. All of the twenty-one republics in the Americas are represented in this union and it is sponsored and supported by these governments themselves. Its purpose is to develop closer commercial and intellectual relations and to promote international co-operation. Without it these nations probably could never have formed an almost solid front against the Axis powers when the second World War came.

Photos by Wurts Bros., courtesy, Co-operative League

Members of the "co-op" have their own grocery store.

Let us look now at co-operation in the narrower sense of "co-operatives," and the co-operative movement.

Consumers' co-operatives are the most important form of this movement. They are, first of all, businesses like any other business except that they are organized and owned and controlled by the patrons they are intended mainly to serve. They have one aim—to serve consumer needs. (Consumer means user. When you buy a loaf of bread to eat, or a school notebook, or a pencil, or a new suit, you are a consumer.)

A group of people, usually neighbors or workers in a certain factory or members of a local church, will get together and set up a grocery store, a gasoline station, a general merchandise or farm-implement or feed store to serve their own needs. They put in some of their savings to start the business and then usually leave some of the store earnings, or dividends, in the business to buy more shares of the co-operative's stock.

Paul Parker photo, courtesy, Assoc. Hospital Service, N. Y.
Group plans for reduced-cost hospital care are popular.

They maintain high standards of service to the consumer and sell only for cash and at about the prevailing market price. If a buyer knows what the consumers' co-operatives charge for a certain item, he has a good idea of the fair price for this item.

A number of such local "co-ops" may form a league with other "co-ops" and organize their own supply service and other services, such as testing for high standards and carrying on educational work. Often these wholesale co-operatives, when they have grown sufficiently large and strong, set up or purchase their own factories, mills or bakeries, sometimes even farms or plantations, oil wells and refineries. They may operate their own trucking and transportation services and even railway oil tanks and oil-pipe lines and ocean liners. Later they may also set up their own credit or banking facilities.

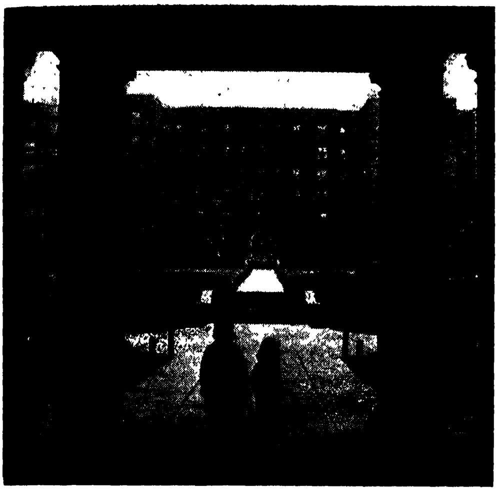
They thus become, not "producers'" co-operatives, but "production" and distributing as well as retail co-operatives—though always with an eye on service to consumers.

There are, of course, many other kinds of consumers' co-operatives. Many of them supply services rather than goods. Among the better known and established of these are farmers' mutual fire insurance and automobile insurance companies; mutual life insurance associations and death benefit and burial societies; farmers' telephone and rural electrification co-operatives; building and loan associations, farm loan associations. Not all of these are always co-operatives in the strict sense.

Among the less known or less tried are co-operative housing projects and apartment houses; rooming houses, restaurants and similar services; group hospital and health insurance associations and co-operative hospitals; book stores and library loan services; laundries; funeral and undertaking services. Tennis courts, bowling alleys and similar services for fun have sometimes been co-operative ventures.

Credit co-operatives are a form of consumer service. The man with only very small savings and little or no life insurance on which to borrow often needs some "ready cash" to pay doctors' bills, to meet a pressing family need or even to get a better bargain on an automobile he may have to buy for his business. He can not borrow from banks and sometimes not even from personal fianance companies because he is not able to provide the security which these institutions require of him; and he can not or does not want to borrow from friends or neighbors. As a rule he can turn only to pawnshops or certain loan offices where interest rates are usually very much higher than they appear to be on the surface.

Credit unions are associations of people, usually working in a single factory or members of some organization or otherwise personally known to each other, who put their savings together, and form a loan fund from which members may borrow. The funds are well protected, the loans are carefully made, though risks are sometimes taken where the needs are great. There are few, if any, salaries or other expenses to pay. Employers often provide space and clerical workers and other services without cost to such credit unions among their own employees. Interest rates rarely amount to more than 1 or 1¼ per cent per month, often little more than



People living in this apartment house own it together. They live more cheaply by sharing the costs.

6 per cent per year. There have been almost no losses or failures recorded. Dividends to shareholders are strictly limited. Like banks, the credit unions operate under government control, nearly half of those in the United States under federal charters.

In a recent year there were about 4,000 such chartered credit unions in the United States and Canada, with an estimated membership of 4,000,000, and an estimated business amounting to a total of $325,000,000.

Finally, there are producers' co-operatives or producers' marketing co-operatives. These are usually groups of farmers, dairymen, cotton-growers, fruit-growers or such, who form associations for the purpose, first of all, of marketing their products at the best price they can get and without paying middle-men's commissions. These associations also provide their members with many other services. And just as consumers' co-operatives take on wholesale and production and other activities, so producers' co-operatives often purchase co-operatively their own feed, gasoline, farm implements and so on, and thus become consumers' as well as producers' co-operatives.

There are a few, but only a few, "production co-operatives," that is, associations operating farms, factories and the like co-operatively for sale on the general market.

Then there are, of course, co-operatives banded together in leagues, going all the way from local and regional groups to nation-wide and international organizations, such as the Co-operative League in the United States, and the International Co-operative Alliance. These help in many ways to promote co-operation.

They usually operate on the so-called Rochdale principles. These are: open membership; democratic control; limited interest on capital; dividends according to patronage; neutrality in religion and politics; sales for cash at market price; constant education; and continuous expansion.

The beginnings of modern co-operatives are usually traced to a group of twenty-eight weavers in the little village of Rochdale in Lancashire, England, who formed the Equitable Society of Rochdale Pioneers in 1844. They raised $140 to open the first "co-op" store, to supply their needs for food and clothing at fair prices.

From Rochdale the movement spread,

Courtesy, Antioch College

Antioch College, Yellow Springs, Ohio, where students and faculty manage school affairs.

with many ups and downs and ever enlarging organizations, all over the British Isles. Later co-operatives became popular in the Scandinavian countries and the rest of Europe, and in other continents as well. Today there are 70,800,000 families in 39 countries buying about $20,000,000,000 worth of goods and service a year through co-operatives. In Great Britain over half of all families belong to the co-operative movement; one-eighth of the nation's retail business, one-seventh of its food distribution and one-eleventh of the wholesale business is done by co-operatives. The banking department of the wholesale society is equal to that of the fourth largest bank in England. In Denmark, 70 per cent of all livestock and farm products are marketed and 70 per cent of all meat packing is done by co-operatives. In most European countries, from one-third to two-thirds of all families are affected by co-operatives.

In the United States and Canada, the movement was slow to take root. Since about 1920, however, farm marketing co-operatives, then oil and gasoline and feed purchasing co-operatives, and most recently general consumers' co-operatives in town and country have increased by leaps and bounds, until in a recent year there were in the United States more than 7,700 marketing co-operatives with an estimated membership of 2,580,000 and an estimated business of $3,180,000,000; and more than 2,700 purchasers' co-operatives with an estimated membership of 1,270,000 and a business of $600,000,000. Among the service co-operatives there were 850 electricity distributing co-operatives with an estimated membership of 1,210,000 and an estimated business of $35,000,000; and 2,000 insurance associations with an estimated membership of 10,000,000 and an estimated business of $185,000,000.

Nearly all co-operative associations carry on educational programs in the work of the particular organization. They explain the principles of co-operative business and co-operative community living.

Co-operatives, then, are a modern expression of the co-operative spirit. Already, as we have shown you, this spirit has resulted in great gains to mankind.

For example, in some communities pupils and teachers and parents—in fact, the whole neighborhood—join in making the school a real community center. Colleges (like Berea College and Antioch College) and universities, too, have sometimes become centers of community progress. Students and faculty and administrators co-operate in planning and managing the affairs of the school; college (or university) and town work together for the common advantage of all. If this spirit of wise co-operation between the educational institution and the community were more widespread, great benefits would result.

As we have pointed out, group-health and medical-insurance programs have already proved successful. They point the way to a much wider range of health services and health activities. There is also plenty of opportunity for increased co-operation in such fields as adult education, play and other leisure-time activities, youth hostels, amateur dramatics and so on.

Increased co-operation is also called for as the radio, television and the airplane come into ever wider use. There would be turmoil if every radio station were to adopt any wave-length it pleased or if air lines were to be set up in regions that already had far more than they needed.

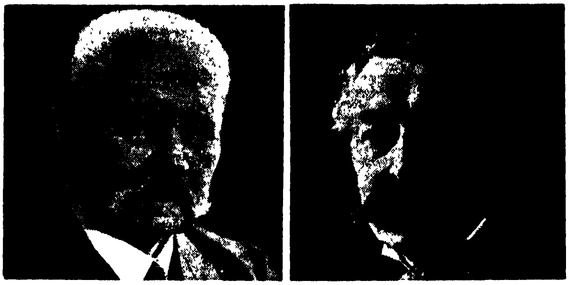
We know what great advances have already been made in the field of pure science because men and women have worked together without thought of self but for the good of mankind. What a wonderful world this will be when all scientists, whatever their country may be, join harmoniously in the good fight against disease and pain and drudgery and poverty!

By William C. Lehmann.

THE NEXT STORY OF OUR OWN LIFE IS ON PAGE 6876.

Courtesy, Columbia University

RECENT EUROPEAN STATESMEN



Wide World photos Henri Manuel

Hindenburg, German president, under whom Hitler gained power. Right, Briand, French premier, who tried to promote peace.

IN other parts of our books we have told you something of the lives of many statesmen who have ruled different countries of the world at different times. In this particular story we tell you about some of the men who guided the countries of Europe in the troubled years from the end of the first World War to the end of the second (1918-45).

This was one of the most fateful periods in all the history of mankind. After World War I the people of nearly every country of Europe were restless and discontented, and this discontent was often reflected in changes of government. At first it seemed that the peoples of Europe were turning toward democracy. Several of the old monarchies became republics, and the ones that retained their kings were constitutional monarchies. The people of many of these countries were not prepared for real political freedom, and their newly won democratic institutions could not stand the strain of the hard times that followed. By the outbreak of World War II, in September, 1939, a number of European countries, including Italy, Germany, Russia, Spain, Portugal, Hungary, Yugoslavia and Greece, had dictatorial governments of one kind or another.

The future of democracy was at stake in World War II. The triumphs of Germany in the first two years of the war represented a threat to every liberty-loving nation. Then the tide turned. Russia, which Germany had invaded in June, 1941, fought back courageously and inflicted heavy losses upon the Germans. The United States entered the war in December, 1941, and brought its vast man-power and industrial resources to the aid of the Allies. As time went on, more and more nations declared war upon Germany and her allies. With the coming of V-E Day (May 8, 1945)—the day of total victory in Europe—that continent was freed at last from the dread rule of the Nazis.

During this period from 1918 to 1945 many statesmen came to the fore in European politics. While we can not tell you about all of them, we shall trace the careers of some of those who were most important.

In Great Britain the early years of peace, following World War I, saw the rise to power of the Labour party. James Ramsay MacDonald, the first Labour prime minister, held office for a few months in 1924, and again in 1929. Of Highland Scot origin, MacDonald was born in 1866 in a humble cottage at Lossiemouth, Scotland. For many years he made a bare living by writing for magazines and newspapers, though later his marriage to a niece of Lord Kelvin brought him some wealth. MacDonald was one of the founders of the Labour party. He did not believe in war and was outspoken in his opinions, even during the first World War.

When, in 1931, England was faced with difficulties, he formed a national government without regard to party distinctions. His own party angrily expelled him as a traitor. This harsh treatment is said to have embittered the last years of MacDonald's life. He died in 1937, while on a sea voyage.

Stanley Baldwin (1867-1947), leader of the Conservative party, succeeded MacDonald as prime minister in 1935. Baldwin had already been prime minister twice, before and after MacDonald's first term of office, and he was an important member of the national government formed in 1931. Baldwin was a cousin of the poet, Rudyard Kipling. His father had been a member of Parliament, but he himself did not enter politics until he was over forty, after a successful career as an industrialist. Baldwin was prime minister during the difficult period when King Edward VIII abdicated the throne in favor of his brother, George VI

Newsphoto

Chamberlain signing the 1938 Pact of Munich. This document gave part of Czechoslovakia to Nazi Germany.

(1936). After the coronation of the new monarch Baldwin was raised to the peerage as Earl Baldwin of Bewdley and retired from active political life.

Neville Chamberlain (1869-1940), who succeeded Baldwin in 1937, was the son of the famous statesman, Joseph Chamberlain, and the brother of the late Sir Austin Chamberlain, a former prime mininster. Neville Chamberlain, like Baldwin and McDonald before him, was anxious to remain at peace with his European neighbors. When, in 1938, Hitler threatened to go to war if the Sudetenland was not returned to Germany by Czechoslovakia, Chamberlain persuaded the Czechs to yield. Like many other people, he believed Hitler's assurances that no further demands for territory would be made. When Germany occupied all of Czechoslovakia in March, 1939, Chamberlain became convinced at last that the democratic powers could never come to terms with Hitler and that they must prepare for a struggle to the death.

Chamberlain was Britain's war leader for something like nine months in World War II. He was unable to cope with problems that called for instant decisions. The disastrous failure of an ill-equipped British expedition to Norway brought about the downfall of the Chamberlain Government. A new government was formed, with Winston Churchill as prime minister. Chamberlain went into retirement; he died in November, 1940.

Throughout the between-wars period, when many of the statesmen of the democratic countries felt that world peace could be maintained by appeasing the dictators, a few wise and fearless men had tried to warn their countrymen against the dangers of such a policy. In Britain, the most outspoken of these clear-sighted statesmen had been Winston Churchill. Though his warnings had gone unheeded at the time, it was to him that Britain turned when she needed a strong, courageous leader to guide the nation and the Empire in the greatest crisis in British history and the history of the world.

Winston (Leonard Spencer) Churchill is a descendant of the first Duke of Marlborough, who was one of England's greatest soldiers and statesmen. His father, Lord Randolph Churchill, was a younger son of the seventh Duke of Marlborough, and his mother was an American, Jennie Jerome of New York. Born November 30, 1874, he was educated at Harrow and Sandhurst Military College, and entered the army in 1895. He served in India and in the Sudan, winning four military decorations before he was twenty-four. He also served as a newspaper correspondent during the Boer War, was captured and made a daring escape.

THE EARLY POLITICAL CAREER OF WINSTON CHURCHILL

He entered Parliament in 1900 and began a brilliant political career. He had many ups and downs in politics, but before he became prime minister in 1940 he had been ten times a member of the Cabinet. As first Lord of the Admiralty in 1914, his distrust of Germany's intentions caused him to take the responsibility of holding the fleet together after the annual naval review at Spithead on July 20. Thus, when actual war broke out, less than a week later, the fleet was concentrated and ready.

In 1915 he returned to the army and fought gallantly in France until recalled to become Minister of Munitions in 1917. He was again First Lord of the Admiralty in May, 1940, when he was called by the King to form a government to safeguard the

Empire and carry on the second World War. Churchill became prime minister at a critical time. A month later the situation seemed almost hopeless. Poland, Norway, Denmark, Luxemburg, Holland, Belgium and France had all been overwhelmed by Germany; Italy had entered the war on the Nazis' side. The British army had lost almost all its heavy equipment in the disastrous retreat from Belgium. Invasion of Britain's shores seemed near at hand.

But Churchill inspired the whole nation to carry on the fight. Great Britain stood up with matchless courage under terrible air raids that blasted her cities and industrial areas. It soon became clear to Hitler that he could never bring the British to terms by means of air bombing alone. Nor did Britain remain on the defensive. Churchill showed that he was a bold leader, who did not fear to carry the war to the enemy; he sent reinforcements to the Empire troops in North Africa at a time when the British were still expecting a German invasion.

Later Great Britain won powerful allies—Russia and the United States—in the war against the Axis. Churchill showed outstanding ability in working with his allies toward a common end. The world was amazed to see how well this representative of the British aristocracy got along with Joseph Stalin, the Russian leader, who had helped to bring about the destruction of the aristocracy in Russia. As for President Roosevelt, he became a close friend of the British Prime Minister.

THE DEFEAT OF CHURCHILL AND THE CONSERVATIVES

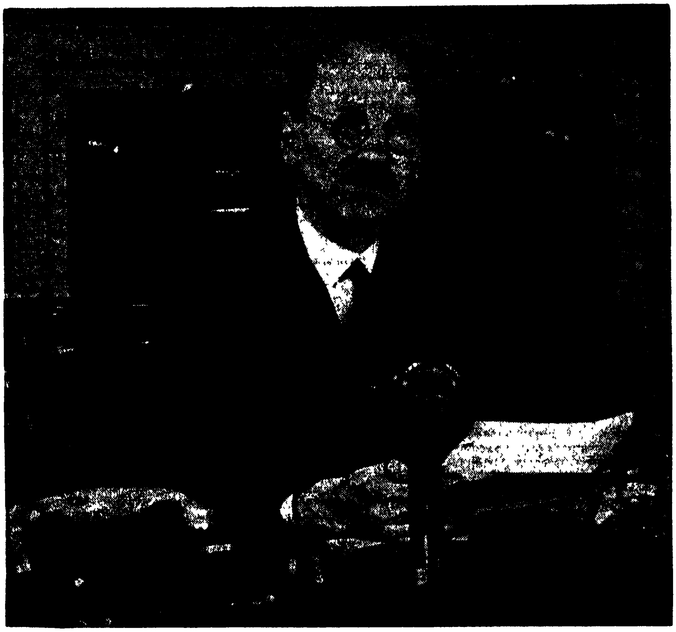
After V-E Day, Churchill's position seemed to be secure. But in the general elections of July, 1945, his government suffered an overwhelming defeat and the Labour party came into power. The reason was that though the British loved and admired the man who had led them to victory, they did not have confidence in the conservative group which he represented. They felt that the times called for a British "New Deal." So Churchill stepped out of power, but not out of politics. He remained in Parliament as a leader of the Opposition to the Government.

Churchill was succeeded as prime minister by Major Clement R. Attlee, the leader of the Labour party. The two men represented entirely different types. Churchill was a colorful and aggressive figure—a born leader of men. Attlee, on the other hand, was a shy, retiring person, noted for his sincerity and his devotion to his work, rather than for his ability to inspire others.

Miller Service Limited

Churchill's determination to fight to the end was an inspiration to all the democratic countries.

He was born in Putney in 1883, the son of a well-to-do lawyer. He was brought up in a comfortable middle-class atmosphere, and was graduated from University College



British Information Service

Prime Minister Clement Attlee and the Labour Party replaced Churchill's Conservative Government. Attlee's was the task of solving post-war problems.

in Oxford. While a college student he became interested in what people of his own station in life called the "lower classes." He went to work as a stevedore for a time in order to come in close contact with the poor. He became a convert to socialism; he taught and gave free legal advice at a settlement center in a London slum.

When World War I broke out, Attlee went into the army and saw service in Gallipoli, Mesopotamia and France. He was a good soldier and rose to the rank of major. After the war he became mayor of the borough of Stepney. In 1922 he entered Parliament as a representative of the Labour party. His first important political post was that of Under Secretary of State for War in Ramsay MacDonald's first administration. His rise in the Labour party from that time on was steady; he became the leader of the party in 1935. Attlee, like Churchill, sternly opposed Chamberlain's policy of appeasement toward Hitler in the days before World War II.

When Churchill formed a coalition government, made up of various political groups, in the dark days of 1940, Attlee became deputy prime minister. He served as the country's leader while Churchill was off on his numerous conferences in other lands.

With the downfall of the Churchill Government in July, 1945, Attlee became the British prime minister. He announced the intention of the Labour party to bring about wide changes in Britain's domestic policy —changes that would give the country almost a socialist form of government. The Government would take over a number of industries; it would raise the standards of the poor by legislation that would protect them "from the cradle to the grave." Yet Attlee's foreign policy differed but slightly from that of the conservative men who had preceded him in office. Like them, he believed in safeguarding the interests of the British Empire in every quarter of the globe.

Aristide Briand (1862-1932), twelve times premier of France, was an important figure in the 1920's. He played a big part in the reconstruction of Europe after the war, conceiving a vast plan for a "United States of Europe." Unhappily, this idea could not be put into effect at that time. He tried to restore friendliness between France and Germany, and in 1926 he and the German statesman Gustav Stresemann were awarded the Nobel Peace Prize. His work was crowned when, in 1928, many of the principal nations signed the Kellogg-Briand treaty outlawing war. He did not live to see his treaty become just another "scrap of paper."

After Briand came a succession of premiers, some of whom served only a short time. Among the best known of these were Pierre Laval (1883-1945), Léon Blum (1872-   ), Edouard Daladier (1884-   ) and Paul Reynaud (1878-   ). Laval made a secret agreement with Mussolini which encouraged the Italian dictator to invade Ethiopia in 1935. Léon Blum, a socialist leader, was premier in 1936 and, for a time, in 1938. He headed a Popular Front Government in which, for the first time, all of the French liberal and radical parties were united.

In 1938 Blum was succeeded as premier by Daladier. Like Chamberlain, Daladier believed at first in peace at any price. He was one of the signers of the Pact of Munich (September, 1938), which permitted Hitler to take over a considerable area in Czechoslovakia. The Daladier Government fell in March, 1940, and he was replaced as premier by Paul Reynaud.

Reynaud was head of the Government when France was invaded; he resigned rather than sign an armistice with the Germans. He was succeded by Marshall Henri Philippe Pétain (1856-   ), a hero of World War I. Pétain signed an armistice with the Nazis; this agreement provided that the Germans were to occupy the northern part of the country.

LEADERS OF TOTALITARIAN FRANCE AFTER HER 1940 DEFEAT BY GERMANY

After the signing of the armistice Pétain set up a totalitarian government with its headquarters in Vichy, and he became the dictator of the French. The aged man accomplished little; his efforts to reorganize the country failed. When the Nazis took over all of France in November, 1943, Pétain became a mere figurehead. Many people believed that he co-operated actively with the Germans. His countrymen tried him on this charge after the German surrender, and he was sentenced to death on August 15, 1945. The sentence was changed to life imprisonment several days later.

When the Vichy Government was first organized, Pierre Laval was named vice-premier. In 1941 he was replaced by Admiral Jean François Darlan, and for a while Laval's name was seldom mentioned in the news. In April, 1942, because the Nazis insisted upon it, Laval was made chief of government in Vichy. Pétain retained his title of chief of state, but Pierre Laval was given the real power.

Laval worked closely with the Germans and drew upon himself the undying hatred of patriotic Frenchmen. After V-E Day he was tried on the charge of treason and he was sentenced to be shot (October 9, 1945). He took poison shortly before the time set for the execution; but the poison proved weak, and Laval met death at the hands of a firing squad (October 15, 1945).

Not all Frenchmen accepted the nazi yoke after the signing of the armistice of June, 1940. A group called the Free French carried on the fight against the Axis outside of France, under the leadership of General Charles de Gaulle. We tell you about this courageous man in the article Patriots in Many Lands.

We have spoken of Gustav Stresemann (1878-1929), who worked with Briand to bring about better relations between France and Germany after the first World War. He was the son of a merchant, and was an industrialist before he entered the German parliament, the Reichstag, at the age of twenty-eight. He did not emerge as a great statesman until after the war, and his career was cut short by death, but he should not be forgotten. Had he lived to complete his work, the recent history of Germany and of the world might have been very different.

GENERAL PAUL VON HINDENBURG, HERO OF WORLD WAR I, PRESIDENT OF GERMANY

The first president of the German republic was Friedrich Ebert (1871-1925), a plain, honest citizen who had once been a saddler. At his death there seemed to be no one to succeed him except the aged Field Marshal Paul von Hindenburg (1847-1934). Belonging to a military family, Hindenburg had entered the army as a young man and had taken part in several wars. In 1911 he had been retired, and one might have thought that his career was over. When, however, the Russian steam roller overran Germany's eastern borders in 1914, someone who was familiar with the territory was needed to push back the invaders. Hindenburg was the man, and in two decisive battles he drove the Russians back. Soon he became chief war lord of Germany, and it was under his command that the German armies came so near to breaking through the Allied forces in France in 1918.

By nature and upbringing Hindenburg was unsympathetic with democratic institutions, but the unity and well-being of his country was more important to him than its form of government. In 1925 he took the oath of allegiance to the republic and for seven years faithfully strove to steer the ship of state through troubled waters. In 1932 he was elected for a second term, but he was an old man in failing health, and he soon came under the influence of men who were enemies of democratic government. In 1933 he appointed Adolf Hitler chancellor, and at Hindenburg's death Hitler became sole head of the German state. The German republic was dead.

Adolf Hitler was born in 1889 in Austria, but went to Munich, in Bavaria, as a young man. He worked at various trades as a young man; among other things he painted postcards and sold pictures. He served in the German army during World War I. After the war Hitler formed the National Socialist, or Nazi, party—a group of discontented men who scorned the German republic, and who wanted Germany to become a great military power again.

Hitler and his followers declared that many of Germany's ills were caused by the Jews, and hatred of the Jews came to be a central part of their program. From the very beginning Hitler's party received encouragement and help from some of the great industrialists, who feared the rise of communism in Germany, and from the army, which had been disbanded under the terms of the peace treaty. In 1923 in a Munich beer hall, Hitler led an attempt to overthrow the government. The Germans call such an attempt a *Putsch*. This one failed dismally and Hitler was put in jail for a while.

THE RISE OF ADOLF HITLER AND HIS MIGHTY WAR MACHINE

For a time Hitler's Nazi party was not taken very seriously. But his fiery oratory attracted more and more Germans in the course of the years. He appealed skillfully to their prejudices, and he was helped by the fact that to many Germans in those days life was a constant struggle. After he became the nation's leader, he succeeded in making Germany powerful again, but at the cost of everything that civilized people hold dear—political liberty, justice and common decency. The Nazis persecuted Jews and liberals without mercy. The Nazi party ruled Germany, and Hitler was made the head of the government for life. The Germans called him their Führer, or leader.

Hitler built up a mighty war machine. When he felt himself powerful enough to act, he broke the provisions of the Versailles Treaty (see Index) one by one. He began to restore to Germany territories that had belonged to her before 1914 and to seize other territories that had never belonged to her. This policy finally brought on World War II.

As a war leader Hitler proved to be astonishingly successful at first. Often disregarding the advice of his generals, he took one bold step after another, and each resulted in a triumph. By June, 1941, he had conquered Norway, Denmark, Luxemburg, Holland, Belgium, France, Yugoslavia and Greece. But in this fateful month he made his first grave blunder, when he gave the order to attack Russia. Though he won vast territories in European Russia, it was at unbelievably heavy cost. From this time on he made one mistake after another. This amateur general brought disaster to Germany.

As his short-lived empire came crashing down about him, Hitler tried in vain to rally his people to fight to the death. The dictator's fate is still a mystery. On May 1, 1945, the German radio at Hamburg reported that the Führer had been killed as he was leading his troops bravely to the attack. Few people outside Germany believe this fine story. It is generally thought that Hitler took his own life; some people, however, hold that he escaped to a foreign land, where he continues to live in disguise.

HOW ITALIAN BENITO MUSSOLINI SWITCHED FROM RADICALISM TO FASCISM

In its early days the Nazi party owed many of its political doctrines to the totalitarian government set up in Italy in 1922 by Benito Mussolini. Mussolini was born in 1883, and as a young man was a socialist. After the first World War, in which he served and was seriously wounded, he turned against his former political beliefs and formed the Fascist party to combat radicalism in Italy. The words "fascist," and "fascism" come from the Latin *fasces*, meaning a bundle of sticks tied around an ax. This was the symbol of Roman justice, and it also symbolizes strength through unity.

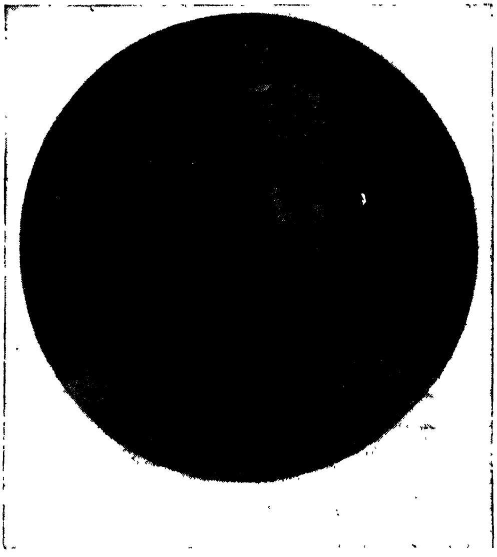
From 1922 to 1943 Mussolini was premier of Italy and he also held various other cabinet offices. Like Hitler he was called the Leader of his people (Duce, in Italian). He was, in truth, a dictator; the Italian king, Victor Emmanuel III, who gave the Duce his support, had no power. Mussolini seemed to bring order and strength to the country; most Italians looked up to him and supported him. They closed their eyes to the fact that thousands of people were persecuted merely because they did not agree with fascism. The Italians had become slaves of the Government.

THE ROME-BERLIN AXIS AND ITALY'S PART IN WORLD WAR II

In 1935 the Duce led his country into a war with Ethiopia, and as a result Ethiopia became an Italian possession. Mussolini and Hitler now joined forces and created the Rome-Berlin Axis, an alliance of the two strongest totalitarian governments in the world. The Italian dictator kept Italy out of World War II for a time; then, when victory for Germany seemed certain, he declared war on the Allies (June, 1940). He thought that Italy could thus win her share of the booty with little risk. Never did a statesman make a more serious mistake.

The fascist military machine failed to meet the test of war against first-rate military opposition. The Italians were defeated on many fronts and their homeland was bombed severely from the air. Mussolini became increasingly unpopular. At last, on June 24, 1943, the Fascist Grand Council forced him to resign. He was succeeded by Marshal Pietro Badoglio, who had never been a warm supporter of fascism.

Later Mussolini was arrested at the orders of the Badoglio Government, but he was rescued by a band of German paratroopers. He had another brief hour of glory when he became the leader of a fascist state set up in the north of Italy with the help of the Germans. When German power in that area collapsed, Mussolini's position became hopeless. He was seized by a group of Italian guerrillas and put to death on April 28, 1945, in a village near Lake Como. This was the sordid end of the once powerful dictator.



The French Marshal Pétain, who fought the Germans in one world war, and worked with them in the second.

Years before the Duce's downfall, Italians had whispered that his successor would be his son-in-law, Count Galeazzo Ciano. This ambitious man was born in Livorno (Leghorn) in March, 1903. After receiving a degree in law from the University of Rome, he entered upon a diplomatic career in the service of the fascist state. He made rapid progress, and when he married Edda Mussolini, the daughter of the dictator, his future seemed assured. After serving as Minister of Press and Propaganda, he became Secretary of State for Foreign Affairs and his influence was held to be second only to that of Mussolini himself.

When things went badly for Italy in World War II, Ciano turned against his father-in-law. He was the leader of the Fascist Grand Council group that brought about the Duce's resignation. Ciano did not gain any personal advantage from this act; not long afterward Italy was forced to surrender to the Allies, and Ciano became a fugitive. He was seized by troops of the fascist state set up in the north of Italy after the surrender. A special court tried Count Ciano on the charge of plotting against Mussolini. The count was found guilty and was executed on January 11, 1944. His diary was published after his death; it throws much light on the corrupt and inefficient fascist government.

A fascist dictator who remained in power after the end of World War II was General Francisco Franco (1892-   ) of Spain. Born of a family which for generations had furnished soldiers to Spain, Franco began his military studies at fourteen, and at thirty-two was the youngest general in the Spanish army. After the overthrow of the monarchy he served for a while under the republic, but in 1936, while governor of the Canary Islands, he flew to Spanish Morocco and from there invaded Spain with Moroccan troops. Helped by Germany and Italy, he fought for the overthrow of the republic, and in 1939, after a long bitter civil war, became head of a fascist government. He became known as the Caudillo, or chief.

Franco kept Spain neutral in World War II; but he made no secret of his sympathy for the Axis powers in the early days of the war. He became more cautious as the forces of the democratic nations gained the upper hand, and later he tried to win their favor. On October 22, 1945, he issued a decree giving the Spanish people a bill of rights. This did not, however, establish democratic government in Spain.

People sometimes talk of the "Russian Revolution of 1917." As a matter of fact, there were two revolutions in Russia in that year. In March, 1917, the Tsar was overthrown and a liberal government was established, of which Alexander Kerensky (1881-   ) soon became the head. For many years Kerensky had been working for the liberation of Russia from the tyranny of the tsars. He meant to remedy the abuses, but he also wished Russia to carry on her part in the war. The Russians, however, were war-weary and terribly disorganized. In November Kerensky had to flee and a more radical group, the Bolsheviks, came into power.

Their leader was Nikolai Lenin (1870-1924), who has become almost a god to his countrymen. He came from the province of Kazan, where his family belonged to the minor nobility, and his true name was Vladimir Ilyich Ulyanov. When he was only seventeen a brother of his was hanged for having plotted to kill the Tsar. Lenin took a law degree in St. Petersburg (now Leningrad) in 1891, but quickly drifted into radical activities, and was banished to Siberia for several years. Upon his release he went to Switzerland. Here and elsewhere in Europe he continued to conspire against the Russian Government until the revolution gave him the opportunity for which he had waited so long.

After Lenin and his followers overthrew Kerensky's moderate government, they tried to make Russia a genuinely communist state, and they planned also to carry the communist revolution to all the other countries in the world. This proved to be a more difficult task than could be managed. Lenin, however, gained a firm hold on the loyalty of the Russian people. When he died his body was skillfully embalmed and put in a glass coffin. This coffin, placed in front of the Kremlin, in Moscow, has become a national shrine.

At Lenin's death there followed a fierce struggle for leadership among his chief followers. One of these was Leon Trotsky (1879-1940) whose real name was Lev Davidovich Bronstein. He was the son of a Jewish farmer. He was arrested for radical activities when barely out of school. Between 1898 and 1917 he was twice exiled to Siberia, spent four years in Russian prisons and twelve abroad. Much of this time he was in New York, where he was a well-known figure in radical circles. In the Russian revolution his military talents were of great importance, and it was he who built up the Red Army. He was a fiery man, vain and easily flattered, but a stirring orator and a remarkable organizer.

The man who finally won the mantle of Lenin was a remarkable Georgian called Joseph Stalin (1879-). He was born

Acme Photograph

At the height of their power, in 1938, Mussolini and Hitler, with the former King of Italy on their left, review troops.

Joseph Vissarionovich Dzhugashvili, the son of a peasant shoemaker in Georgia, in the Caucasus. He was educated for the priesthood, but he became a revolutionary while still a youth. Between 1902 and 1913 he was arrested and exiled six times. Each time he managed to escape, but instead of leaving the country, he took up his work again under a different name. One of the names he used was Stalin, which is Russian for "steel." That is the name by which the world knows him today.

STALIN GAINS CONTROL OF RUSSIA AND BANISHES LEON TROTSKY

After Stalin became the secretary-general of the all-powerful Communist party, he had as much power as any dictator. Trotsky's influence steadily decreased. At last, in 1928, Stalin had this political foe banished. Trotsky spent his remaining years in exile; he lived first in Turkey, then in Norway and finally in Mexico, where he was assassinated in the year 1940.

We tell you about the history of Russia under the leadership of Stalin in the chapter called Russia as It Is. He ruled the country with an iron hand. Russia made remarkable progress during this period, and most Russians gave the "man of steel" their support. When the German invasion of Russia in 1941 brought the country to the brink of defeat, Stalin united all Russians in the struggle to preserve the fatherland. He proved to be an inspiring leader. When the day of victory came at last, in 1945, he received the title of generalissimo, or supreme commander. Today he is without question the most powerful national leader in all Europe.

Viacheslav M. Molotoff is another outstanding Russian statesman. Born in 1890, Molotoff was an active revolutionary for years. He was influential in the Bolshevik group which seized power in November, 1917, and he rose to high office in the communist government that the Bolsheviks set up. As Soviet Commissar of Foreign Affairs, he played an important part at the United Nations Conference on International Organization, held at San Francisco, California, in April-June, 1945; he helped to draw up the United Nations Charter. In a shift of government posts, which happens quite often in the Soviet Union, Molotoff left the office of Foreign Minister in March 1949, but remained the First Deputy Premier.

One of the most beloved leaders of the period between the two world wars was Thomas G. Masaryk (1850-1937), the creator and first president of Czechoslovakia. Before 1918 the country had formed part of the Austro-Hungarian Empire. But the people had never forgotten that they had once been independent. Masaryk, a professor and writer, made himself the spokesman of their ambitions and entered the Austrian parliament. When the first World War broke out he escaped from the country and worked ceaselessly, first in Switzerland and then in the Allied capitals, for Czechoslovak independence. In 1918 he went to Washington and obtained a declaration of support from the American Government. His wife was a New York woman whom he met when she was studying music in Vienna.

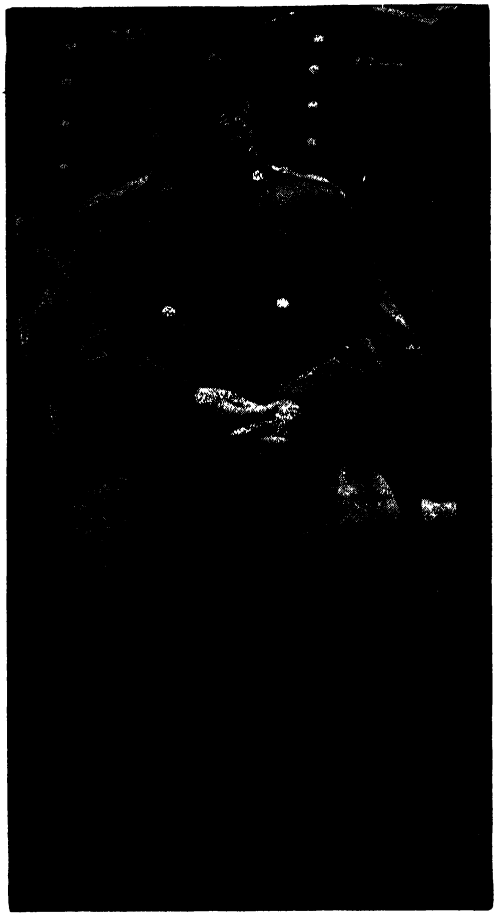
THOMAS G. MASARYK, FATHER OF CZECHOSLOVAKIA AND ITS FIRST PRESIDENT

Even before the war was over and the new state had been set up, Masaryk had planned a government, and was regarded as its head. Czechoslovakia was officially brought into being through the peace treaties, and Masaryk became its head in fact as well as in name. Eduard Beneš (1884-1948) became Foreign Minister of the new state. He and Masaryk had been closely associated in the work for independence. When Masaryk resigned in 1935, because of his advanced age, Beneš became the second president of Czechoslovakia. We tell you about his career in the article Patriots in Many Lands.

Like Czechoslovakia, Poland regained her independence after World War I. Ignace Jan Paderewski (1860-1941) became Poland's first premier. He was one of the most famous pianists the world has ever known; but he did not prove to be a strong political leader. Poland, which had been a battleground in the war, was in ruins; she was torn by fierce domestic strife. The times called for a man of iron, and not for a gentle soul like Paderewski.

After Paderewski's downfall the power in Poland went to Marshal Joseph Pilsudski (1867-1935). From his early youth Pilsudski had worked for Polish independence. When only twenty-one he was exiled for plotting against the Russian Government.

When war broke out in 1914, he threw in his lot with Germany and Austria, believing Russia to be the greatest enemy of his people. When Russia had been beaten, he turned against Germany, and was then imprisoned by the Germans until the war ended. He was acting Chief of State of Poland from 1919 to 1922. Four years later, disgusted with the inefficiency of the existing government, he put himself at the head of his soldiers, overthrew the government and became dictator. He remained in power until 1935, the year of his death. (See Poland and Its People.) Four years later Poland was overrun by the nazi hordes.


British Information
Stalin at Yalta, where Allied war strategy was planned.

Yugoslavia was another victim of Germany in World War II. After the Germans occupied the country in April, 1941, King Peter II fled to London, where he set up a government-in-exile. Within Yugoslavia a guerrilla group, led by General Draga Mikhailovich, kept up the struggle against the Germans. This group, called the Chetniks, was under the orders of the government-in-exile. Later another guerrilla group, known as the Partisans, was formed in Croatia, a district of Yugoslavia. The Partisans were led by Joseph Broz, who was known to his followers as Marshal Tito.

Tito had had an adventurous career. He was born in Croatia in 1890, and learned the trade of a metal-worker. At the time when World War I broke out, Croatia was a part of Austria-Hungary. Tito was drafted into the Austro-Hungarian army. He deserted to the Russians, and they put him in a military prison camp. He was freed when the Tsar's government was overthrown in March, 1917, and he became a member of the revolutionary Bolshevik party.

After the Bolsheviks took over the government in November, 1917, Tito joined the Red Army, organized by the Bolsheviks; he fought for three years in Russia's civil war. In 1923 he went back to Croatia, and there he became a labor leader. Little is known of his career from that time until World War II, when he suddenly became prominent as the leader of the Yugoslav Partisans.

TITO'S DICTATORSHIP REPLACES THE GOVERNMENT OF KING PETER

In December, 1943, Tito announced the formation of a Yugoslav National Committee of Liberation, a provisional government which did not recognize the government-in-exile of King Peter. As time went on, the National Committee of Liberation became more and more powerful; the Partisans received increasing amounts of Allied aid. When Yugoslavia was freed from the Germans, the government-in-exile remained in London, while Tito and his National Committee ruled the land. Attempts to bring together the two opposing Yugoslav groups were unsuccessful.

On November 11, 1945, national elections were held to decide the political future of the country. Tito's enemies declared that he was determined to set up a communistic form of government. They were sure that the elections would not be fair, and they announced that they would put up no candidates of their own. Naturally, Tito's supporters won an overwhelming victory, and they took over the control of the National Assembly of two houses. Soon afterward, the Assembly approved a proclamation by Tito, abolishing the monarchy and setting up a republic. Tito has the title of premier; he is really the dictator of the country.

With Tito we end our survey of recent statesmen of Europe—good men and bad, strong men and weaklings. Some of them, at least, will never die in the memory of man.

THE NEXT STORY OF MEN AND WOMEN IS ON PAGE 6912.

Bird life on guano islands in the Bay of Pisco, Peru, is beautifully portrayed in this museum habitat group.

The AMERICAN MUSEUM *of* NATURAL HISTORY

A VISIT to New York is not complete unless you have seen the American Museum of Natural History, one of the most fascinating places in the whole city. It is a huge building with a number of wings, set among green lawns just across the street from Central Park. Thirteen of the building's twenty-three acres of floor space are devoted to colorful and interesting exhibits.

Suppose, for instance, that you have been reading stories of Indians, and of life on the plains when they were the grazing-grounds of the bison, or buffalo. How much more interesting these stories will be after you have seen a real teepee with models of life-sized Indians sitting about in it, and how real the stories of buffaloes will seem after you have seen a herd feeding upon a real bit of the Texan plain, with a buffalo path across the corner.

This kind of exhibit is called a habitat group, and the museum has many of them. Some show birds or animals or undersea creatures, surrounded by the kind of plants, rocks and scenery that form their natural surroundings. Others show human beings, such as the Indians we have mentioned, and all of them have been so skillfully designed and built and lighted that to look at them is like looking out of a window into a real living scene.

Four large halls are devoted to Indian life. The life of the Indians of the Pacific coast is shown in the long central hall. The canoe that you have seen through the doorway is a huge dugout in which a party of Indians are going to a feast called "potlatch," during which they will give away all they possess to gain honor among their fellows. The man who is standing at the stern of the canoe is the medicine man who is going to direct the ceremony. The canoe, which is 64 feet long and 8 feet wide, was dug out of the trunk of a single tree. It is a good seaworthy boat and will hold forty men.

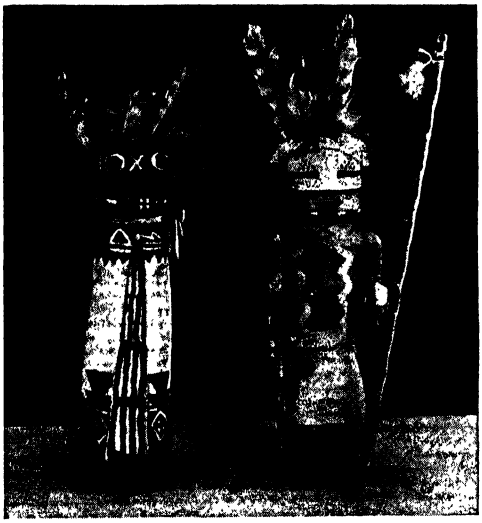
Against the walls and down the sides of the hall there are cases in which you will see the grotesque-looking totem poles and house poles made by the Indians of British Columbia and Alaska, and in the cases there are specimens of the fine blankets woven by the Chilkat Indians, the baskets for which the West Coast Indians are famous, the masks used in religious ceremonies and many other interesting things.

At the end of the hall you go into a smaller hall, in which you will see the home life of the Eskimo. In one group an Eskimo woman is cooking blubber over a stone lamp; in another a woman is fishing through the ice. The fur clothing of these people is shown, and so also are their implements and their carving in bone and ivory.

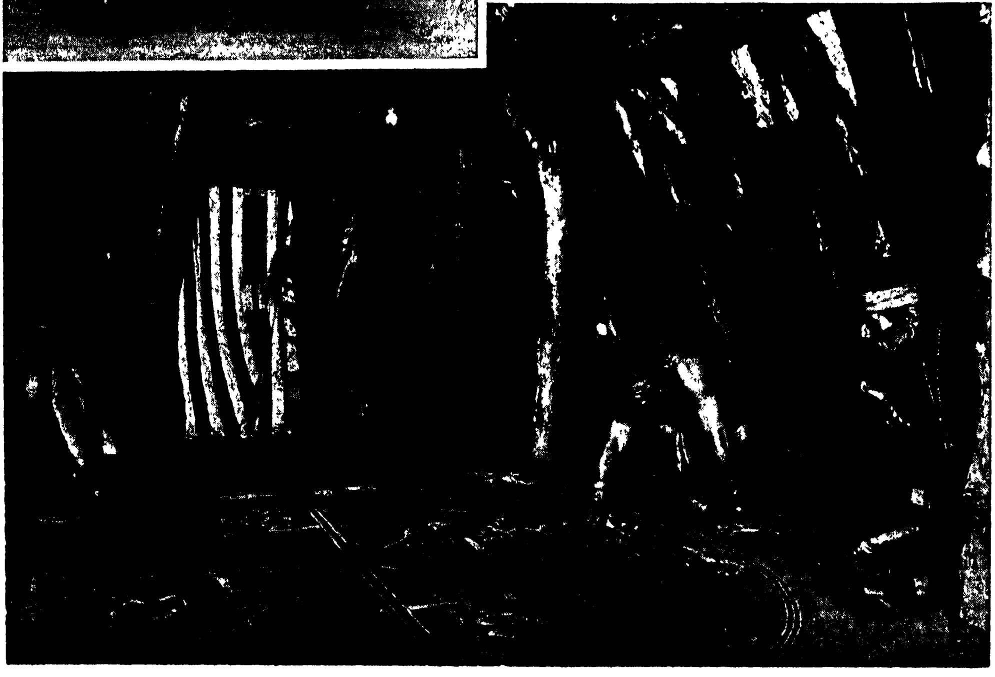
When you leave the central hall, turn to the right through the entrance hall, to find more Indians. Here there are three large halls devoted to the life of the Indians of the woodlands, of the plains and of the Southwest. You will see fine wampum belts, stone weapons, rude agricultural implements, wooden and birchbark vessels, wooden trays and spoons. In the hall where the teepee stands there is also a model of the earth-covered houses in which some of the Indian tribes of the plains lived. In the next hall there are models of the cliff-dwellings, and of the pueblos of which we have read in the story of Arizona, and some beautiful Navajo blankets.

On the same floor there is a very fine collection of the wood of American trees. Each tree has been cut so that you can see the bark, the grain of the wood when it is cut in boards, and the rings which show its growth. With each specimen there is also a spray of leaves and flowers and a spray of fruit and leaves, so that the whole life of the tree may be studied. One of the most interesting things in this hall is a cross section, or slice, of a redwood tree, or sequoia, which was nearly a thousand years old when Columbus discovered America. The great trunk was sixteen feet in diameter, and there are pins set in the section to show how large it was at different epochs in world history.

Passing through this hall, you come to a



These fierce warriors are Hopi Indian dolls. They were originally made to be used in the colorful Hopi religious rites and afterwards became toys for the children.



A Navajo medicine man making a sand painting on the floor of his hut. He will use the painting in the curious and elaborate Navajo ceremonies to heal the sick.

most interesting collection which shows the many forms of life in the world as we know it, from the tiny ameba, the lowest form, up to man. Some of the minute animal forms of life are shown by exquisitely wrought models in glass or wax, made much larger than the originals so that they may be seen better. Some of the models are the size of a man's hand, with pale tinted tendrils as fine as a hair, which in their natural size can hardly be seen with the naked eye. In the marine collection there are such fascinating things as sea stars and sea lilies, corals and sponges. Life under the sea is shown, and you can study the shellfish, crabs and lobsters as they appear in their native haunts. You remember that we have told you of the life of the mosquitoes which cause malaria and yellow fever. Therefore you will be interested in the models of this insect which show its growth from the tiny larva to the full-grown insect.

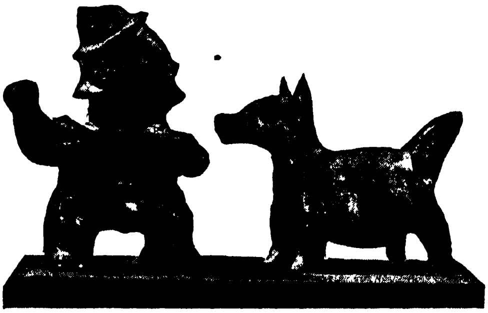
On the next floor, in one of the wings, you will find snakes, lizards and salamanders, cases of birds' nests and eggs. Farther on, exhibits show the life of the Mayas, of which we give you an account in the story of Central America and Mexico. You may also see a copy of the great calendar stone made by the Aztecs, who followed the Mayas in having a year of 365 days.

From this hall you reach another in which you may study the long, slow progress of man from early times. The first rude weapons and implements made by man are shown. Copies of the pictures which the cave-men made in the caves of Europe are here, and some of the pictures that these early men made on bone and ivory. In another room beyond there are copies of cave-paintings made by the Bushmen of South Africa; some of the looms that they use in weaving show how they make their cloth, and there are specimens of the cloth itself and of garments made from the cloth.

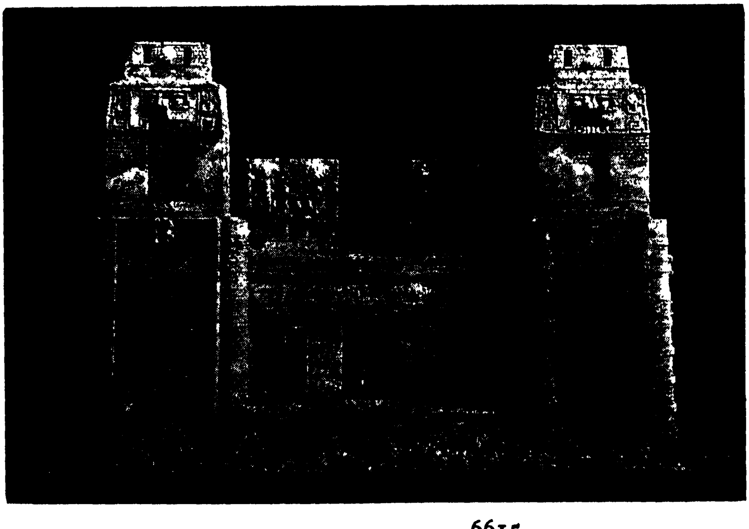
Perhaps you have wondered whether the stories you have read of the work done by the Negro peoples of South Africa could possibly be true. You will no longer doubt it once you have seen their process of manufacturing cloth, the work of their blacksmiths in axes, knives and spears, that is shown in the African Room, and the beautiful ivory work in trumpets, ax- and knife-handles, trays and boxes.

Leading from the second floor is the Akeley Memorial Hall of African Mammals. So lifelike are the habitat groups here that we seem to be looking across a living part of Africa. Other African exhibits can be seen in the New York State Roosevelt Memorial which is dedicated to the accomplishments of President Theodore Roosevelt.

There is nothing in the whole museum

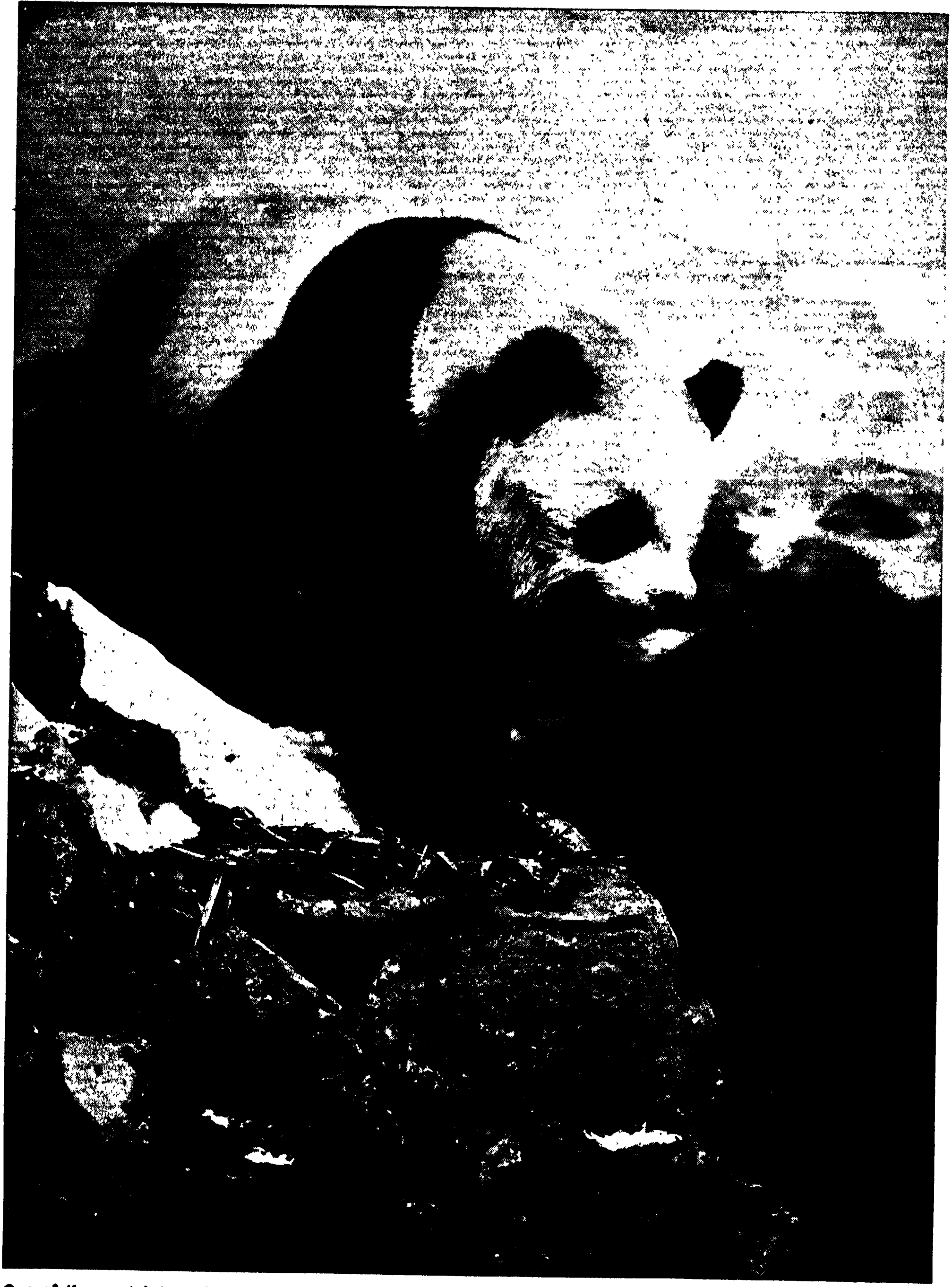


This Mexican pottery boy looks as though he were trying to teach his dog a few tricks. The dog, however, seems to have other ideas on the subject and is standing firm.



A model of the Maya temple at Rio Bec, Mexico. The museum has a number of carefully scaled models of the impressive temple architecture of Mexico and Central America.

THE TEDDY BEAR'S PRINCIPAL RIVAL



One of the most interesting and unusual mammals is the Giant Panda. Until comparatively recently the animal was unknown, and only a few specimens have been brought into captivity. The Giant Panda looks like a huge black and white teddy bear; but it is actually a member of the raccoon family. It makes its home in the bamboo forests which grow on the sides of the mountains of western China. The Giant Panda group is one of the newer habitat groups in the museum. It will be one of a number of groups in the Hall of North Asiatic Mammals.

more colorful and fascinating than the bird collections. The Whitney Memorial wing, an eight-story building, contains the largest study collection of birds in the world. There are more than 750,000 specimens from all parts of the globe. Among these are thirteen habitat groups of birds of the Pacific, from the coast of South America and Hawaii to New Guinea and Australia. As you go through the great hall you see wonderful scenes from many of the islands whose names we heard so often during the war with Japan. There are also special exhibitions of birds of paradise, rifle birds, South Sea lories and other strange and beautiful birds; and another exhibit of birds of the Malay Archipelago. There is a Gallery of Bird Art, a Hall of the Biology of Birds, and on the top floor of the wing there are laboratories where scientists study living birds.

Another of the beautiful places in the museum is the hall in which the groups of American birds are placed. Here, too, each case is designed to look like the scenery in which the birds live. The man who organized this collection traveled sixty thousand miles to obtain the various specimens. Artists went with him to make drawings of the places in which the birds were found, and from these drawings models were made and pictures painted. The illusion is so perfect that you can scarcely tell where the foliage and trunks of trees or the rocks in the foreground end and where the painted picture begins. The group that shows bird life on Cobb's Island, Virginia, is so real that you almost expect to get a whiff of the salt sea air. In the foreground is the white, shell-strewn sand, with its straight tufts of grass, and the sea-gulls hovering about. Beyond are the piled-up clouds, and the gray-blue sea breaking in lines of foam.

If you have been reading about the Incas of Peru you will be interested in the hall given over to South America. Here there is a curved stone chair in which an Inca may have sat. There are beautiful cloths woven of cotton and llama's wool and embroidered by the hands of women who had been laid to rest long before the Spaniards came. Here you will find the spindles that held their wool and cotton; the neat work baskets used hundreds of years ago; the copper needles with which the embroidery was made; the simple looms on which the cloth was woven. There are fine pottery jars and silver vessels which bring vividly before you the lives of those strange people who had worked out a wonderful civilization of their own.

Beyond this you will find the collection

A sculptor preparing a lion for a habitat group. First he fashions the anatomy of the animal as it would be without the skin. The final form is made from this model. Carl Akeley perfected this method of mounting animals.

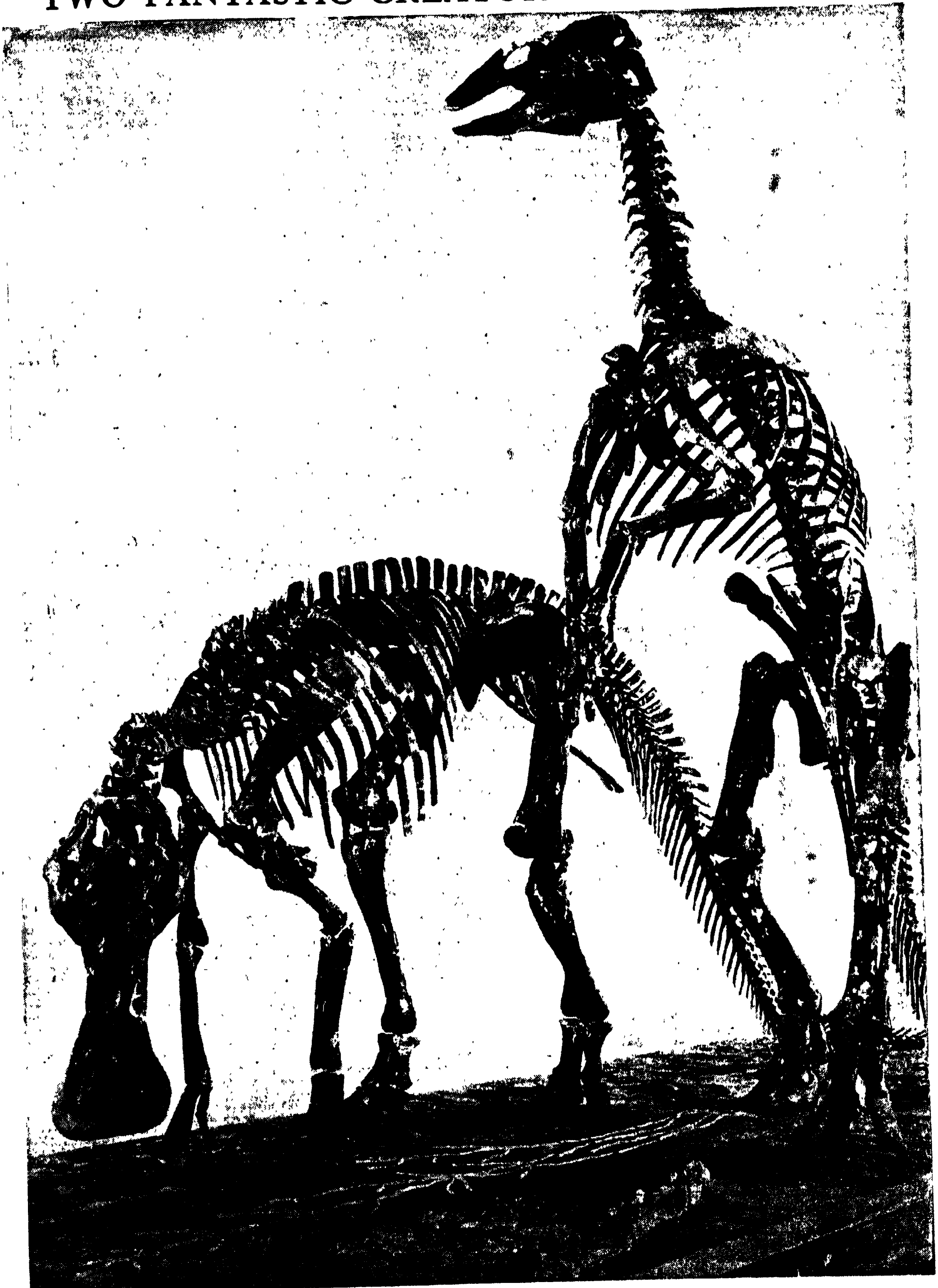
WILD LIFE IN NATURAL SETTINGS

The Alaska brown bear is the world's largest carnivore, (meat eater). Its appearance is a sign of spring in Alaska, for it goes into hibernation in the fall and comes out in April or May. In the Hall of North American Mammals it is shown against the background of the Pinnacles, treacherous mountains on the Alaskan peninsula. Near the creek we see an otter scurrying home, frightened by the sudden appearance of the bear.

This baby ostrich has just hatched from its egg and is beginning to make its way in the world. It is not standing beside a slender tree trunk as you may have thought. That trunk-like object is the leg of one of its parents standing guard anxiously, to make sure the little fellow does not fall prey to animals that consider a young ostrich a tasty dish.

Although they do not appear very handsome these black rhinoceroses are having a fine time wallowing in the mud. They can be found in the Akeley Memorial Hall of African Mammals, along with other members of their family.

TWO FANTASTIC CREATURES OF LONG AGO



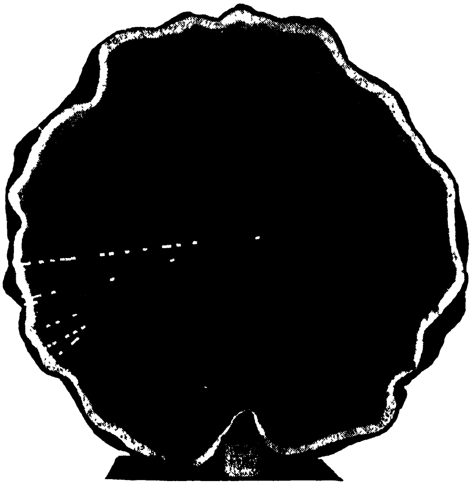
These duck-billed dinosaurs were strange creatures. They used their duck-bills in gathering the water plants which were their favorite food. They walked on their hind legs and when swimming used their tails as propellers.

which represents life in China before Western civilization began to change conditions there, and the life of the people who inhabit the east of Siberia.

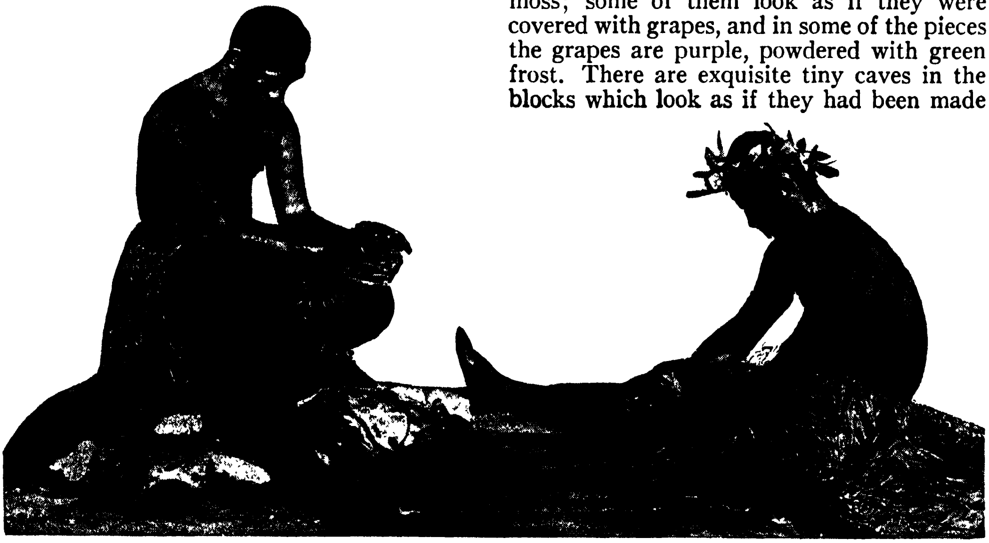
In one of the eastern halls on this floor you will find more animals. A curious platypus from Australia is of interest, and hares changing from white to brown show us how this phenomenon progresses. More interesting is the model of a huge sulphur-bottom whale which hangs from the ceiling in the center of the room. This monster, which is seventy-nine feet long, is an exact model of a whale that was captured off Newfoundland.

The collection of insects, which comes next, includes thousands of species. There are cases of beautiful butterflies and moths. A mourning-cloak butterfly with folded wings, inside a hollow log, shows how a few of these fragile insects sleep through the winter months.

Perhaps you think geology is uninteresting, and the life of the earth dull and drab-colored. But suppose you now go up to the fourth floor, to the hall that is devoted to minerals. Walk straight down the hall, and at the end you will see a real cave brought from Virginia. In one part of the cave there are beautiful pillars; in another the stone of which it is made looks like folded drapery through which the light shines. You remember what you have learned about the action of water dissolving limestone and depositing the salts in another place, and you know that this beautiful thing has been made by the action of water. In the glass cases across the hall you will find specimens of malachite and azurite. You have always thought of malachite as a highly polished, very cold marble-like stone, but here you see something quite different, something that scarcely looks like a mineral. Some of the masses in the cases look as if they were covered with green velvet, others as if they were made of soft green moss; some of them look as if they were covered with grapes, and in some of the pieces the grapes are purple, powdered with green frost. There are exquisite tiny caves in the blocks which look as if they had been made



If Columbus had sailed to California he might have seen this giant sequoia, for it was nearly 1000 years old when he came to America. This cross section of the massive trunk is sixteen feet in diameter.



Right: a Tahitian fire-maker rubs a blunt stick in the groove of another stick until the dust ignites. Left: this Tahitian man is grating coconut. He sits on a stool which has a knife blade in front. The blade grates the white "meat" of the nut. This is one of the groups which show the life of people in remote parts of the world.

for halls for the fairies. These little caves were made by the action of water on copper, just as the larger caves were made by its action on limestone. The blocks of malachite were taken out of a copper mine. There is a model of a mine in the corner of the hall, which shows how the mine is worked and the ore taken out.

Not far away you will find another hall which glows with the color of precious stones that catch and reflect the light. Here you will find crystals of royal purple amethyst, yellow amber and smoky topaz. There are lovely pearls and brilliant diamonds, and all the others stones of which we tell you in the Story of Precious Stones. More interesting still, perhaps, is the collection of crystallized minerals, in their rough state, which make you wonder at the beauty dug out of the earth.

Beyond the Hall of Minerals you will find two halls that illustrate life in the Pacific islands. In front of the door a Tahitian fire-walker is walking over heated lava blocks. On one side of him a group is grating coconuts; on the other, a group is weaving mats for a house. In the corner of the room a Maori warrior breathes defiance against the world. In the cases there are royal feather capes from Hawaii, carvings in wood and stone and models of canoes, rolls of cloth and the looms on which it was woven. In another hall life in the Philippine Islands is shown. A woman is weaving at a loom; near by there is a model of a Philippine house, and not far away another house is perched in a tree top.

We have told you stories of the monsters that lived long ago on the earth, of great mastodons, of monstrous sloths, of great lizards. Here you will find the actual skeletons of the monsters themselves. There is a giant ground sloth which, it is believed, some of the cave-men of South America tamed long ago; a great saber-toothed tiger gives us an idea of the terrors which confronted early man; mammoths and mastodons tower above us, and the skeleton of Jumbo is placed here so that it may be compared with those of his giant ancestors.

In the Hall of Fossils you will find the frightful saurians. The huge brontosaurus is dreadful-looking, but it was a gentle beast that fed on water weeds. The frightful allosaurus, and the still more frightful tyrannosaurus, were carnivorous or meat-eating, and preyed upon other animals. These huge reptiles were not so large as the brontosaurus, but the allosaurus ate him up, and the tyrannosaurus ate the duck-billed dinosaurus. These skeletons were taken from the earth, where they had been buried for millions of years. The bones that had fallen apart were put together, piece by piece, like the sections in a puzzle, and they were set up here to give us an idea of how they looked in life three million years ago. One of the animals actually shows the skin with which in its lifetime it was covered. In another hall you will find skeletons of the horse, and you may trace his development upward from the tiny eohippus,

Sharks in pursuit of a sea turtle make a vivid and dramatic undersea spectacle in the Hall of Living Fishes.

no larger than a fox, to the heavy draft horse of today.

In 1935 the museum opened the Hayden Planetarium. The auditorium, which is a circular chamber, seats about 750 people. Over the chamber is a white dome of stainless steel—the screen on which light images of the heavenly bodies are cast by a projector. Here we can see every object in the sky that is visible to the naked eye. The rising and setting of the sun, moon and stars are shown just as they occur in nature. With each display a lecture is given on astronomy.

Some thrilling special shows are given in this theater of the heavens. One of these shows several different ways in which the world might come to an end. In one the earth is struck by a big comet; in another it collides with a hit-and-run star; and in a third with the moon. Another show which has been extremely popular is a trip to the moon. In this the watcher seems to be rocketed the 240,000 miles in a space ship, and is landed on the dead planet right in the middle of a lunar crater, with the strange scenery of the moon all around. Of all the shows at the planetarium, however, none is more impressive than the yearly Christmas show. Here we are taken back to Galilee on a night two thousand years ago, and we see the heavens with the constellations just as they were when the shepherds saw the Star and heard the angels heralding the birth of Christ.

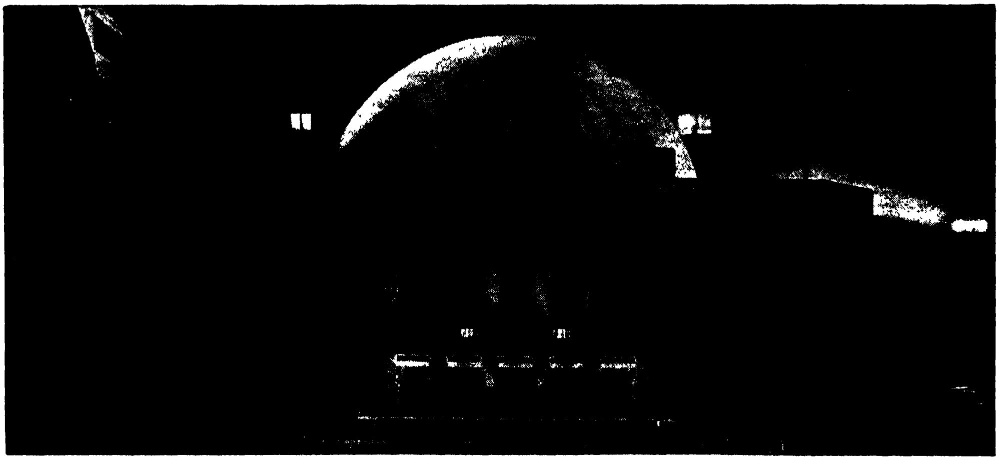
During the war, classes in navigation were held at the planetarium and thousands of men in the Army and Navy went there to learn how to find their way over land and sea by means of the sun and moon and stars.

Children are especially welcome at the Museum of Natural History, and thousands of them visit it every year, some in groups with a teacher, others with their parents, or even alone. No matter where you wander through this interesting place you will meet children everywhere, eagerly studying the things that interest them and laying up stores of knowledge that will make their lives richer and fuller. To help children who can not see understand the things about which they read, classes are held for the blind, and the little ones are allowed to hold objects in their hands to learn about them by the sense of touch.

This is not the end of what is done for boys and girls. Pictures for lantern shows have been made, and these are sent to teachers in other places who ask for them to show them to their pupils. It might be said that in this way the museum brings its treasures to the children in distant cities and in country places who can not come to see them.

The American Museum of Natural History has a record of over fifty years of public service. Each year around 2,000,000 persons visit the exhibition halls and the planetarium. There are lecture courses delivered from time to time. The library of the museum, containing over 100,000 volumes, is open to scientific workers. The popular publications issued are handbooks, leaflets and a magazine. They give the public interesting information in the fields of natural science.

THE NEXT STORY OF THE UNITED STATES IS ON PAGE 6701.



All pictures from the American Museum of Natural History

The entrance of the Hayden Planetarium at night. The Planetarium is the scene of many exciting shows. There is a special Christmas show, a trip to the moon, and one which shows a number of ways in which the world might come to an end. The Army and Navy made use of the Planetarium during the war to instruct thousands of men.

A stag beetle, armed to the tip of its "antlers."

THE GREAT BEETLE FAMILY

THE beetles are among the most numerous of living things. In species they outnumber backboned animals by perhaps three to one. In individuals they are as the sands of the sea. There are beetles no bigger than a pin's head, and monsters, such as the goliath and elephant beetle, nearly as big as a man's fist. A South American giant beetle is six inches long and nearly as broad.

The beetle tribe is favored, in the struggle for existence, in several ways. Beetles have a coat of armor against attack; they can move their powerful heads more freely than other tiny creatures, and they can eat so many substances that they are at home practically everywhere.

Beetles are four-winged; but the front pair is little more than a protective covering for the hind pair. The front pair, called elytra, meet as a rule straight down the back, and guard not only the rear wings but also the soft hind parts of the body. Not all beetles have elytra. In fact, some have no wings at all. Generally, when this is so, it is the females that have lost the power to fly, but there are species in which both sexes lack true organs of flight, though the horny elytra are still there.

The beetle's head is, as a rule, more broad than long, and sometimes, as in the weevils, has a long proboscis, or trunk, like an elephant's trunk in tiny scale.

The head is furnished with two large eyes, and sometimes with smaller auxiliary eyes, called ocelli. The lenses may be plain, but more frequently the eye is composed of many facets. Sometimes it is divided, for what purpose is not plain in all cases. In the whirling water beetles this division is complete, so that the two eyes of these creatures are, in effect, four.

The antennae, or feelers, are attached to the head. We might write a chapter on these organs alone. They are of many shapes and designs, though nearly always, in all species, composed of eleven-jointed segments, which give extreme flexibility.

They are organs of touch, but more than that. It is thought that smell and hearing also are in these feelers. But do beetles hear? In the ordinary sense they may not. They

Above photo, New York Zoological Society; right, Roman Vishniac

The "beetling" beetle, one of the Lamellicornia, which looks threatening indeed when its clubbed antennae lie against the head and overhang its mouth parts.

Left and right photos, U.S.D.A. Bureau of Entomology; center, Cornelia Clarke

Left to right: a larder beetle, which raids human food; a green tiger beetle; a carrion, or burying, beetle.

may catch air vibrations and little shocks communicated through solid bodies, and feel, as we believe fish do, rather than hear as we do.

There are beetles that create sound by scraping one part of the body against another. Sometimes it is the legs against the edges of the wing-cases, sometimes it is the rubbing of one part of the body against another that has a specially rough, file-like surface. Surely, it may be thought, with such elaborate preparations as these for making sound, there must be some sort of hearing sense in the insect.

At any rate, scientists recognize the antennae as the receivers, for beetles have no ears. Some of these wonderful antennae taper away to a bristle-like extremity; some have thread-like ends, though uniform throughout in thickness; some, again, are composed of rounded joints, like strung beads. There are feelers with long processes arising from each joint, feelers thickened gradually toward the ends, like those of butterflies, feelers that suddenly swell into thickness, and feelers, as in the case of the cockchafers, that have elaborate fan-like structures.

The scientific name for beetles (their order) is Coleoptera. The name comes from two Greek words for "a sheath" and "wings." It was first used by Aristotle when he observed the elytra, the firm protective sheaths serving as coverings for the hind wings.

Are beetles foes of man? Not all of them, by any means. Many of them eat grubs and caterpillars that would otherwise destroy our gardens. Among these allies are the tiger beetles, of which more than a thousand species are known. They are lovely creatures, with fine metallic hues on their coats of mail. They abound on sunny paths and sandy shores of rivers and ponds and along the ocean, flying and running swiftly. All the species living in the United States are ground beetles, but in the tropics there are some that live on trees. Side by side with the tigers are other beetles doing good work for man.

One of the most astonishing is the master gunner of the order, the bombardier beetle. The big fellows of the order belong to the tropics, but under stones where it is neither too wet nor too dry you may find, even in northern lands, a little one as interesting as any in the world. By some means the bombardier beetle has contrived a defense of astonishing efficacy.

When threatened it emits a highly acrid offensive fluid. That, of course, is not unique, for many insects do the same thing. The marvel here, however, is that the fluid issues with what, in the insect world, must be a tremendous report. A dozen times in succession the little gunsquirt is fired, and at

The wireworm looks like a train of tiny plates fastened together in rather clumsy fashion. It is not really a

each pop out comes a tiny jet of fluid. But it does not remain a jet. It breaks up into a finely divided spray almost like gas.

As the carburetor of a motor car sprays fluid gasoline into a vapor for the cylinder, so this beetle mechanism converts the little jet of acid into a spray of vapor unpleasant to the nose and capable of making the eyes water.

What comic perfection of defense it seems to us, this little marvel going about his tiny world amid the roots of vegetation and under a beetle's dome of stone—a pebble half an inch in diameter—angrily gassing his enemies.

The family of Carabidae have the *Carabus* genus as their type, 300 species in number. Carabus beetles are remarkable for the fact that all, save one known species, are confined to the North Temperate Zone. The solitary exception is found as far away as southern Chile, a problem in distribution that makes many an entomologist pucker his brow.

One of the Carabidae common to East Indian isles is only a museum curiosity with us. It is worth seeing, for by some queer change it has the shape of a fiddle, and has the popular name of violin beetle. Many of the group are skilled burrowers, in woods, in the banks of streams, and even down to the margin of the sea. They reveal themselves but little; they lie hidden in their secret places most of the time.

The Carabidae brought us to the water's edge. Let us pause by a pool and see their fresh-water cousins, the carnivorous water beetles, at their daily occupation. There are several species in the family Dytiscidae, the Latin name given to these fine creatures because it means "fond of diving."

worm, but the larva of the click beetle. Wireworms are one of the farmer's worst enemies.

Photos above and below, Roman Vishniac

A water beetle, the champion diver among insects.

We all know these beetles, though not their story. See one pop up from below to the surface, stick the nether extremity of its body out of the water to collect a bead of air, then turn and dive again, and we know at once it is dependent on the atmosphere for respiration, as we are. How, then, does it breathe in the water beneath which it stays so long at a time?

The air it collects is snared beneath the elytra, and is gradually absorbed in the body by spiracles that run along both sides of the body and thorax. Its larvae are air-breathers also; there is no gill-breathing stage for them as there is for the tadpoles of Amphibia. They also rise to the surface to take in air. Does this mean that the air-breathing chrysalis lies, during its trance and conversion, in the water? No, for here is one of the strangest things in the beetle world. The egg is laid in a hole bored by the tubular drill of the mother in the stem of a reed or other water plant. It hatches there and the larva enters the water. But when it is about to become a chrysalis, instinct impels the larva for the first time to seek the land, make itself a little burrow, and there lie quietly to suffer its change, in contact with air. It leaves its burrow a perfect beetle, and flies to pond or ditch.

Back now to the land, to find ourselves challenged by that ferocious-looking little gentleman in black, the devil's-coachhorse. He is much better in performance than appearance, for, roaming far and near, he is ever after grubs, slugs, snails and other organisms that eat our garden plants.

What a fund of courage there is among the beetles! This one, if you threaten him with a finger or a pencil, will open his jaws and curl up his body with ferocity. He will seize the pencil with his sturdy jaws and hold with such grim wrath that you may swing him round and round without shaking him off. One has seen a rove beetle bite a caterpillar in half at a single effort and march off with one-half of his kill in his formidable jaws. Rove beetles are easily recognizable by their long linear black bodies with remarkably short elytra and seven or eight horny abdominal segments. Though sometimes an inch in length, they are more commonly minute, inhabiting wet places under stones, fungi, or moss on the bark of trees.

Cornelia Clarke

"Tumblebugs" are really scarab beetles.

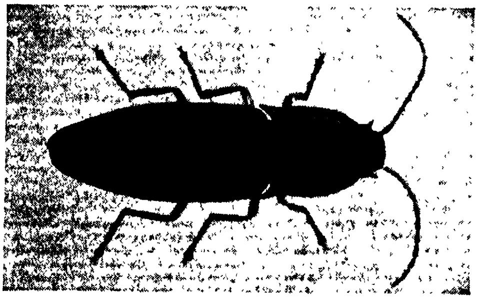
Our rove beetles haye an unpleasant odor. Possibly some of the genus distil a sweeter perfume, or are ant and termite tastes different from our own? Whatever the case, certain rove beetles are welcome guests in the cities of ants, where, like the feebler plant lice, they act like milch cows and give out a milky fluid to the ants and termites in exchange for board and lodging A curious thing is that the roves that house with termites do not lay eggs, but produce their young alive, just as mammals do.

Our common yellow ant houses a beetle that is not a rove. It is one of the *Claviger,* whose antennae have but six segments, instead of eleven, and whose head has no eyes. The clavigers are parasites, and could not live without the ants. They dwell underground forever with the ants, and like the queen ants and the babies, they are fed by the worker ants. As a set-off for this service they secrete a juice dear to the palate of the ants. This beetle is sightless and wingless. It can neither see nor fly, yet it flourishes. There are nearly a score of species of it and all, so far as is known, make ant homes their refuges.

Next a larger group, the carrion beetles, includes those whose habit of burying their feasts has earned for them the title of sexton, or burying, beetles. Whatever doubts there may be about the hearing of beetles, there is no question as to the marvelous keenness of the sexton's power of smell. A mole, a vole, a mouse, a bird may die with no burying beetle in sight; yet, with extraordinary speed, up come the winged undertakers to perform their useful task.

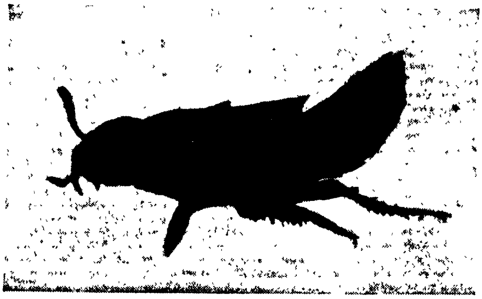
They remove the soil grain by grain from beneath the little corpse, and gradually sink it in a hole, then cover it over. The funeral is decently performed, the rites complete as far as we may see. But down there in the darkness life is to be born of death. The mother sexton lays her eggs in the dead body. The eggs hatch there; and the larvae eat the flesh in which they were cradled.

The Histeridae, 1,200 species strong, are interesting, though unlovely. While their staple food is manure, they attack and devour the great and powerful dung beetle. When disturbed the insects retract the antennae and feet, appearing as if dead. Their nearest allies, the Nitidulidae, live on decaying vegetable and animal matter, and even bones. Some are found about the punc-



U.S.D.A. Bureau of Entomology

Pick it up and "click" goes the click beetle.



L. W. Brownell

The devil's-coachhorse, a friend in disguise.

tures through which sap escapes from the trunks and branches of trees.

The Dermestidae is a widely ranging group of beetles that in the adult stage are harmless, but in the larval condition work havoc in bacon and cheese, in the stuffing of upholstery, and in the treasure cabinets of our public museums and private collections. There are some that like dried skin, feathers and fur; there are those whose appetite is freshest for rare insects. The bristly larva hides very skillfully in the body whose interior it consumes, leaving only the shell ready to fall to pieces at the slightest jar.

A word next on the stag beetles, the finest members we have in the order in the North. The larvae live in the wood of old oak and other trees of ancient record. So great is the amount of structural work to be done in getting them from the grub to the perfect condition, with coat of mail, and jaws resembling the antlers of stags, that three or four years elapse before their growth is complete.

SCARAB BEETLES, SACRED SYMBOLS TO THE ANCIENT EGYPTIANS

These lead us to a mighty host called the Lamellicornia, the group in which are the scarabs, the sacred beetles of the Egyptians. There are scores of species of scarabs, common to southern Europe, where Henri Fabre studied them and wrote one of the most fascinating of his essays on the life habits of these consumers of animal refuse. They include the mammoths among insects, and in the tropics are most numerous, most quaint and most gigantic. They are easily recognizable by their clubbed antennae, which when laid against the head so overhang the mouth parts as to give rise to the term "beetling." One species, common southward, is called the "tumblebug," as it incloses its eggs in pellets of manure, holds them between its hind legs and rolls them away to a place of safety. Its body is bright copper color, and the male has a large horn on its head.

Nearer at hand we have lamellicorn examples in the well-known June bug, or dor bug, which comes with the first warm nights of early summer. A great thud repeated again and again against the screen door or window signals its efforts to get to the circle of light within our house. These great brown blunderers are nearly an inch in length, with yellowish hairs beneath. The larva lies on the roots of grass and is often turned up by the spade or plow. It is injurious to growing corn and wheat. Then comes the pupa in its rude earthen cocoon in May, and the developed beetle in June feeding voraciously on the leaves of fruit trees.

The click beetle is an enemy of man, though it appears to be one of nature's funny men. You pick it up and it clicks like a clockwork toy; you put it down and it leaps into the air with the amusing alacrity of a still better toy. But in its larval stage it is the dreaded wireworm that by its numbers is ruinous to crops.

Roman Vishniac

A firefly, the beetle that makes its own light.

Have you ever seen land where root crops have come only in small patches, leaving great spaces of soil bare? It is the work of wireworms below. When a field has become infested, the farmer puts on his heavy roller before sowing, and tries to make the subsurface so hard that the pests can not get up to gnaw roots nearer the surface, but you know as you witness the operation that it is only a temporary remedy. The soil should be opened up so that birds, one of the natural police forces in such matters, may get at the larvae and devour them. The wireworms get their name from the shape of the bodies of the larvae, which are long and cylindrical.

Next come the delightful fireflies and glowworms, rightly placed here, for they are not worms but beetles. Everything that crawled was a worm to our ancestors, down to Shakespeare's day and beyond; even the snake with which Cleopatra killed herself was called a worm, and so the crawling founts of light, the *Lampyris noctiluca* of Europe, were called glowworms.

It is probably the wingless condition of the female glowworm that causes the blunder, for the male is a bold winged flyer, and it is to call him to her side that the somber little lady among the grass, supping on snails and slugs, lights her gorgeous lamps—little gleams of greenish radiance bursting at her will from organs arranged along the edges of the last two segments of her body. The male has, in a lesser degree, this gift of radiance, and he lights up too, as some think, with a view to frightening off enemies, but the signal is probably more frequently used as a call to his mate than as a threat to a foe.

We may handle a firefly, even when it is flashing its light, without any fear of a burn. This strange fact has long interested scientists, because the humble firefly's "cold light" is almost ten times as efficient as proud man's electric light.

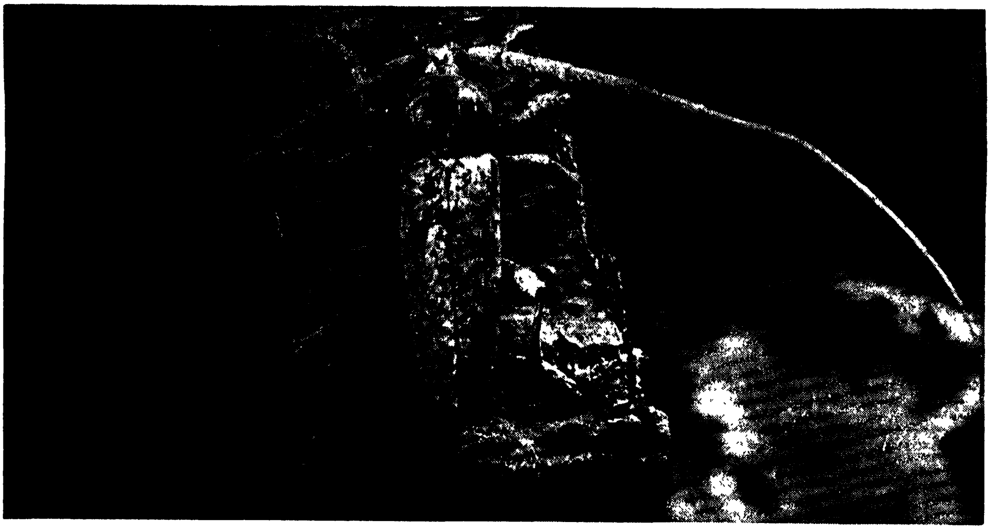
From the firefly's body, scientists have obtained two complex chemical substances. When, under the proper conditions, these substances are put together in a tube containing oxygen, cold light is produced.

So much for light. Let us turn to the dark, and the boring beetles that delight in it. Chief of them for our purpose is the so-called death tick beetle, or, as science knows it, the *Anobium tessellatum*. The furniture people call it the woodworm, because its soft-bodied larvae, when found in the wood, look like little worms. It is a beetle that lives in dry wood and feeds on the substance of its home. It has a hard little head which it bangs on the floor of its dwelling as a signal to its mate in some other tunnel in the furniture. And the answer is made by similar means. The taps are the beetles' code of signaling.

The sounds are heard only when rival noises are hushed. Naturally they are most perceptible in the still watches of the night, as, for example, in a sick-room. So in course of time a sound heard only in the stillness of a sick-room came to be reported as an omen of death. This is, of course, only a superstition. The so-called death tick is always ticking, day and night, wherever it lives.

There is a danger in the beetle far more real than this legend. It is destroying some of the noblest woodwork in the world. It has been found in fine old buildings—in the timbers of cathedrals, churches and mansions famed in literature and history. To get rid of the beetle, once it has found a home in a building, is a costly task.

It is a blessing that the longicorn beetles do not breed as fast as some others we have



Roman Vishniac

Feeling its way with the long antennae, a longicorn beetle tunnels through furniture, feasting on the wood.

considered. Their larvae are so deliberate in growing up that a seventeen-year cicada is a mere youth in comparison with the veteran babies of the order. They are white, helpless-looking things in the larval stage, but some of them seem to show remarkable wisdom.

A CRADLE IN THE TREES, MEANT TO FALL

Some longicorn mothers, the girdlers, having laid an egg in a small branch of a tree, cut a ring right around it, so that the wood withers, and eventually down comes baby, cradle and all, with the happiest results. But in another species the infant carves out its own fortune. Having reached the desired degree of growth, it enters a large limb of the tree, bites it all around, and thus secures its descent to the ground. And in that wooden sanctuary the baby becomes a chrysalis and comes forth a winged longicorn beetle.

When food, warmth and moisture from sap are favorably furnished, some longicorn grubs complete their change in a year, but under bad conditions their infancy may be enormously prolonged. The *Prionus brevicornis,* which lives in the balm of Gilead and in the Lombardy poplar, is said to require twenty years to pass from the grub stage to the imago.

We need more information as to the stages of life of other longicorn larvae. For example, *Monohammus confusus* has been known to issue from the wood of furniture manufactured fifteen years before—how long had it been there before the tree was felled?

Other longicorn larvae have buzzed out of tables twenty-eight years old, and one traveled about the world for years, quietly devouring the wood of the "tree" on which a careful and observant owner stretched his shoes.

THE GLOBE-TROTTING BABY— THIRTY-ONE YEARS OLD!

But the record, so far as is known, was attained by a larva that had traveled all over the world in the wood of a pencil box. She was the property of a doctor, and her owner never had any trouble with her except for the fact that she was rather unmannerly, in the sense that she was noisy in eating, and at nights, when banqueting on her timber, would wake him up with the clatter of her jaws. After twenty-five years a fresh piece of wood was added to her cradle-larder. For another six years she gnawed. Then she died, certainly thirty-one years old and possibly much older, the oldest baby ever known on earth.

L. W. Brownell

Though never heeded, children still warn the ladybird.

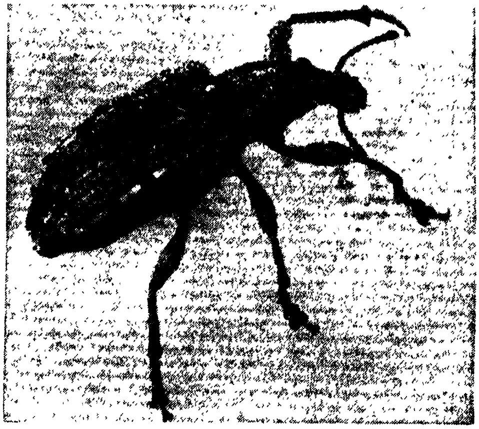
There remain multitudes of other beetles for the student of the subject: oil beetles, whose larvae lie in wait for bees, seize them by the hair, and ride home to dwell in the hive and fatten on bee grubs; all the company of weevils, which infest our nuts, clovers, foliage, apple blossoms, cabbages, grain and tree trunks; the beetles that devour our peas and beans; the ladybirds or "ladybugs," which police our roses and other growths in our gardens imperiled by the greedy plant lice.

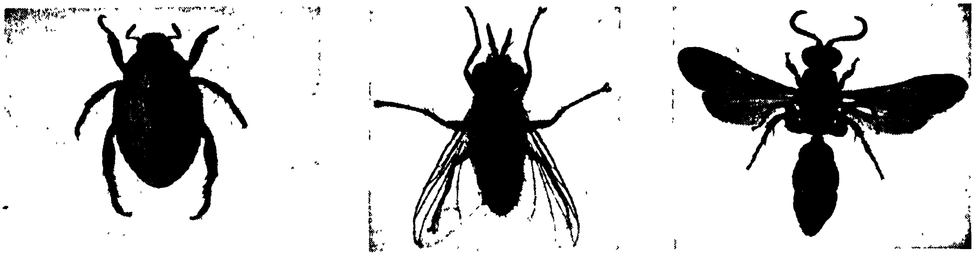
We do not know half the species of beetles that are found in the world. But we do know what an immensely significant part these swarms of big and little creatures play in the rise and fall of human fortunes.

THE NEXT STORY OF ANIMAL LIFE IS ON PAGE 6721.

One of the tribe of hairy pests, a New York weevil.

Roman Vishniac





USDA, Bureau of Entomology

A Japanese beetle and two enemies: a fly (Centeter cinerea), center; and a wasp (Tiphia popilliovora), right.

What Harm Do Japanese Beetles Cause?

ARMIES with guns and airplanes are not the only invaders that nations face. One of the most unexpected and successful invasions of modern times has been the conquest of part of the eastern United States by the Japanese beetles. These warriors with their gorgeous armor of green and bronze have attacked the gardens, orchards and fields of New York, New Jersey, Delaware, Maryland and Pennsylvania, and have established outposts in several other states. Even the rooftop gardens of New York's tall buildings have suffered from the ravages of raiding parties.

This beetle begins its depredations in June or July, eating the fruit or leaves of many cultivated plants, including raspberries, blackberries, grapes, apples, cherries, corn, red clover, soybeans, roses, hollyhocks, elms, birches, lindens and oaks. After it has eaten all that it needs, it lays tiny white eggs in the earth. The grubs that hatch from these eggs eat roots, doing much damage to lawns during the late summer. They spend the winter cozily underground, passing through the pupa stage to come forth as glittering-winged adults the next summer.

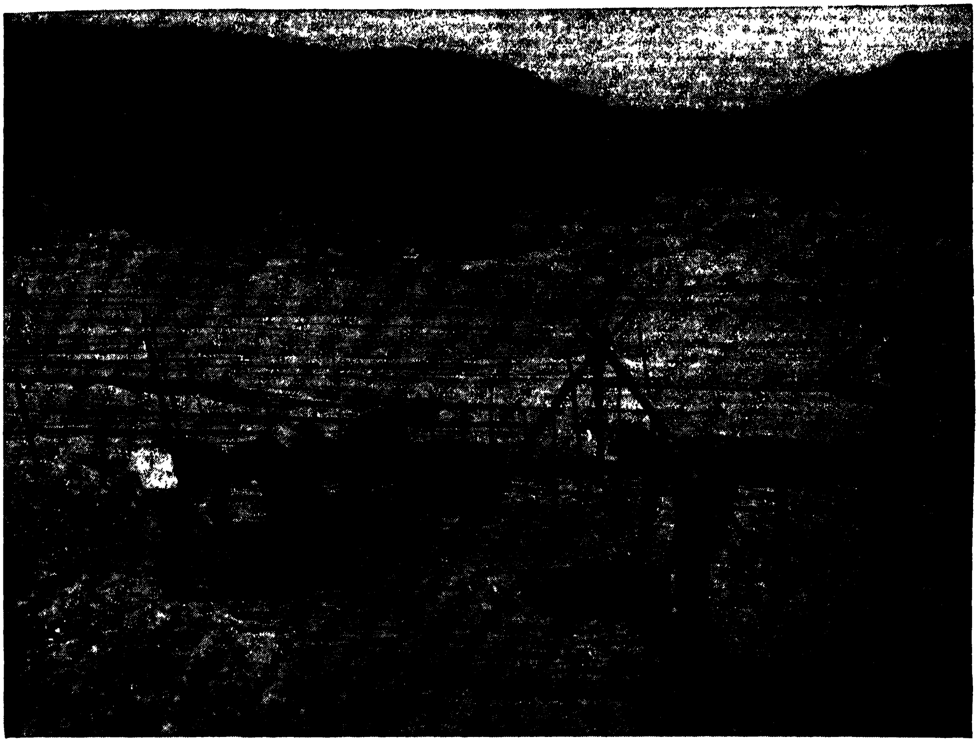
Centeter cinerea deposits on the beetle's back the eggs that will soon hatch and eat the beetle alive.

In Japan, their native land, these beetles are not a pest, partly because they have natural parasites that prey upon them, and partly because the Japanese practice such intensive cultivation. In America they are a serious pest, causing heavy loss.

Up to 1916 *Popillia Japonica,* as this beetle is called, was known on this side of the Pacific Ocean only to scientists, but in that year a few of them were found in New Jersey. Little attention was paid to them at first, but by 1920 they had spread and become such a pest that the United States Department of Agriculture, after making a thorough study of their life-history, began to look for some natural enemies to help exterminate them.

As a result of these studies, which were partly carried on in Japan, several enemies of the beetles were found and introduced into the infested areas. One of these is a two-winged fly and two others are wasps. These defender insects, as we may call them, lay their eggs in or on the bodies of the beetles, and the larvae that hatch out of the eggs eat the beetles and destroy them. Colonies of these defender insects have been very successful but it may be some years before there are enough of them to be of real value. In the meantime the war still goes on, and gardeners and farmers use various sprays and mixtures to kill their unwelcome guests. The most effective are preparations of arsenate of lead (a deadly poison), which are spread on lawns during the egg-laying season to kill the grubs as they hatch. Sprays used on the foliage do not seem to do much good, for the full-grown beetles are very particular about their diet and will not eat any unusual substance. This may save the particular plants that are sprayed, but it does not actually get rid of the beetles. They just go to some other spot to get their food.

THE NEXT WONDER QUESTIONS ARE ON PAGE 6691.



Courtesy, Pan American World Airways System

Searching the earth for diamonds in Brazil. Africa is the great diamond continent, but South America is gaining.

The WORLD'S MINERAL WEALTH

OF all the minerals to be found in the earth's crust and in the sea, coal, iron and petroleum are probably the most necessary to us at present. From coal, oil and air—"slime and soot"—are made plastics, dyes, synthetic rubber and clothing. The most important use of coal and oil, however, is as fuel.

It will help you to form a more accurate picture of the mineral resources for the world's work if you remember that:

1. There are still large areas of the globe, especially in Siberia, China and around the Poles, that have never been surveyed. They may contain rich deposits thus far unknown. Roads, railroads, air routes, have not yet reached all of these far places. Some lie hidden in perilously high mountains or under the vast ice caps of the far north and south.

2. The mineral wealth of the sea can hardly be exhausted. Common salt has been recovered from it for centuries, but there are many other minerals—potassium, magnesium, phosphates—which the oceans have in abundance. However, cheap sources of electric power and heat are needed to extract them.

3. Industry is not completely dependent on mines and other natural sources for its metals. Most used minerals can be reworked. Scrap iron, for instance, is an extremely important item in world trade.

4. Minerals are rarely found in a pure state. Most are found in combinations with other elements. We call such mineral compounds ores. Some ores are rich in mineral. Other ores are so poor that they remain unworked until, perhaps, a cheaper method of extracting the mineral is discovered.

5. One metal may be the by-product of another. They are mixed in the ore. Lead and zinc, for instance, are often found to-

Sovfoto

Digging iron ore in the Ural Mountains region of Soviet Russia. The train will carry the ore to the blast furnaces where the iron is separated from the impurities. The table on page 6642 tells you that the Soviet Union is one of the world's greatest iron producers.

gether. In fact, they are rarely found alone.

6. Man's inventive genius changes the world's needs from time to time.

Iron. The Lake Superior district is the richest in the United States. While it is possible that the high-grade ores there may be exhausted in the next quarter-century, huge reserves of lower grade exist. Alabama, Pennsylvania, New York and Wyoming also have iron in the ground.

In western Europe, France has the most productive mines, in Lorraine. There are a number of rich deposits in the Soviet Union. The Krivoi Rog mines of the Ukraine are famous, and also the mines at Magnitogorsk, in the Urals. Undeveloped veins exist south of Moscow, in western Siberia (south of the Kuznets Basin) and in eastern Siberia (northwest of Lake Baikal).

Other deposits in the earth's crust which have hardly been touched as yet exist in Newfoundland and Cuba; India, Iran, Afghanistan, Borneo and New Guinea; on the central west coast of Africa; and in Brazil.

The earth's crust is about 5 per cent iron, with only oxygen, aluminum and silicon being in greater proportion. The metal has been used by mankind for centuries, come articles made of iron dating back almost 5000 years.

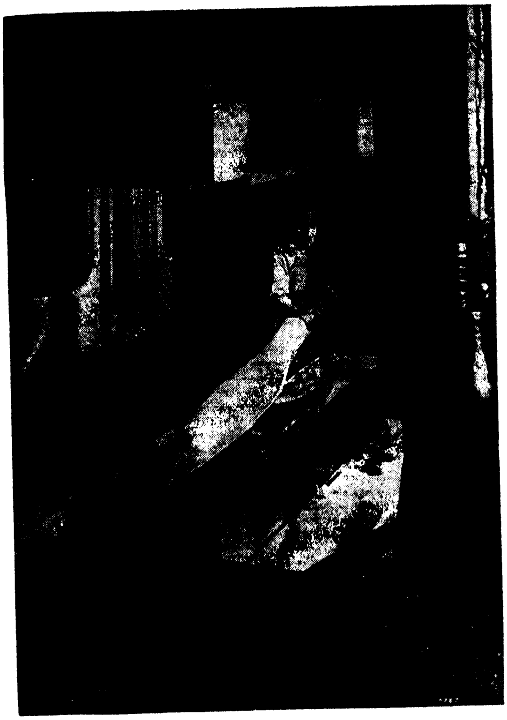
Enormous amounts of iron are used each year. As you know, steel is made from iron.

Aluminum. The present period in history is sometimes called the Age of Light Metals, largely due to the tremendous development in the use of aluminum. Of all the metals, only steel is produced in greater quantity, and steel weighs three times as much as aluminum. By alloying, or mixing, aluminum with only a small quantity of various other metals, depending on the use for which the alloy is intended, a strong, yet light metal is obtained. This lightness combined with strength is, of course, the main reason

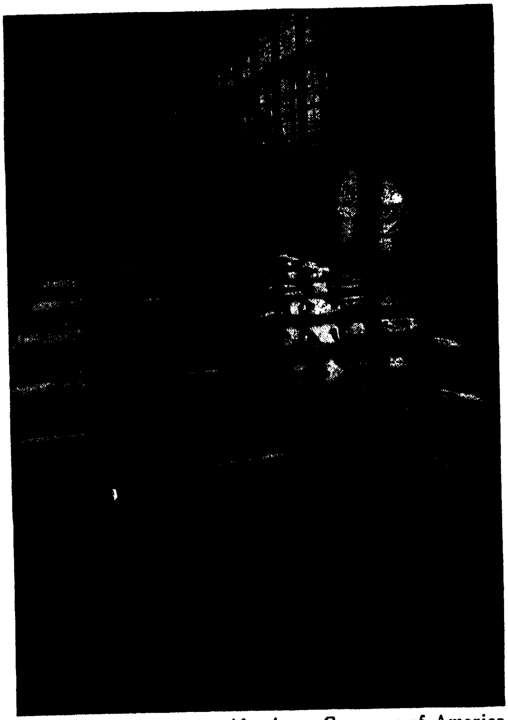
SOME PROBABLE RESERVES OF IMPORTANT MINERALS

Reserves means the quantities in the ground. As further discoveries are made the figures may change a great deal. Reserves of petroleum are given in thousands of barrels; of the other minerals, in thousands of metric tons (1 metric ton = 2,204 pounds). Soviet Union includes both European and Asiatic territory.

	COAL	PETROLEUM	IRON ORE	COPPER ORE	LEAD ORE	NICKEL ORE	ZINC ORE	CHROMITE
North America	3,750,000							
United States		40,000,000	1,500,000	20,000				
Canada				13,100				
Newfoundland				6,700				
Cuba			3,500					
South America	30,000							
Brazil						6,000		
Peru							10,000	
Chile				1,000,000				
Africa	200,000							
Belgian Congo				2,000				
Europe	2,000,000							
Soviet Union			18,000,000	100,000				
Bulgaria				250	350			
Yugoslavia							5,000	
Albania								500
Asia	10,000,000							
Burma					3,411		3,411	
Oceania	50,000							
Australia							5,000	
Philippines								10,000



Forging a strong aluminum alloy propeller blade. Aluminum, when combined with other metals in alloys, is very useful because it is light as well as strong. It is highly prized for use in airplanes, and streamline trains.



Pictures, courtesy, Aluminum Company of America

With the aid of modern, high-speed equipment, sheets of aluminum alloy are today produced at much greater speeds than were possible a few years ago. Aluminum is the second most common element in the earth's crust.

why aluminum is so important in the aircraft industry.

Aluminum is the most common element in the earth's crust, except silicon. There are small quantities of aluminum in almost all rocks and clays, in the soil of your garden and the woods and fields you know. But the richest source is a clay called bauxite. It takes about four tons of bauxite to produce one ton of aluminum, and the process consumes enormous amounts of electricity.

The bauxite deposits of Guiana and Hungary seem well-nigh inexhaustible. Brazil has large stores. Nyasaland (in southeast Africa) is believed to have about sixty million tons.

There are less rich ores than bauxite which may some day be used. Of these minerals, labradorite and andalusite occur in the Scandinavian Peninsula; and alunite, aluminum shale and other aluminum clays occur in Japan.

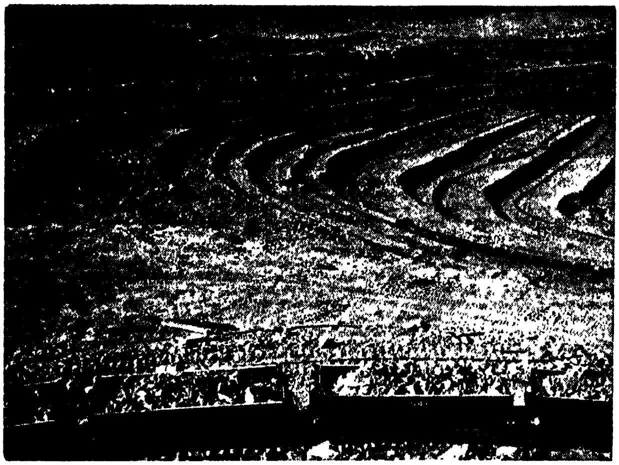
Magnesium. This metal is now the great rival of aluminum, particularly in the manufacture of products such as airplanes. The pure metal has a low melting point and, when heated above this point, catches fire easily and burns intensely. It is one-third lighter than aluminum and can be shaped more easily. When it is alloyed properly, it also has greater tensile strength; that is, it will not break under strain as readily.

Magnesium is another extremely abundant element in the earth's crust. It is never found in the pure state, but occurs in a number of ores, particularly magnesite, dolomite and brucite, and in brine or water containing certain salts. Sea water is an excellent source. Four parts in 1,000 of sea water are magnesium chloride; extraction is fairly simple.

Production is still very low in comparison with common metals; but the demand for magnesium has grown more than for any other metal, spurred on by new methods of extraction and of welding.

Austria is the second largest producer of magnesite. Great Britain uses dolomite and sea water. In the United States the metal is produced from brine, in underground wells near Midland, Michigan, and from sea water, at Freeport, Texas, on the Gulf of Mexico, and at San José, California. Every country with a seacoast or salt lakes has one source ready at hand. Plans are now going forward

MINING AND REFINING COPPER

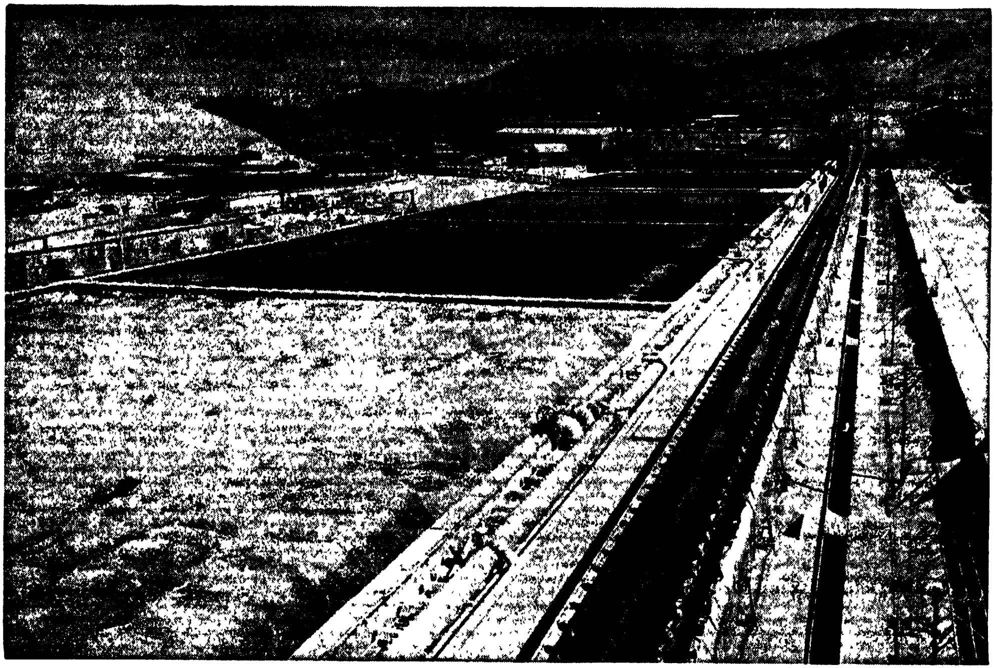


Courtesy, Coordinator of Inter-American Affairs

An open pit copper mine at Chuquicamata, Chile. The United States is first in copper production, with Chile second and Canada third.

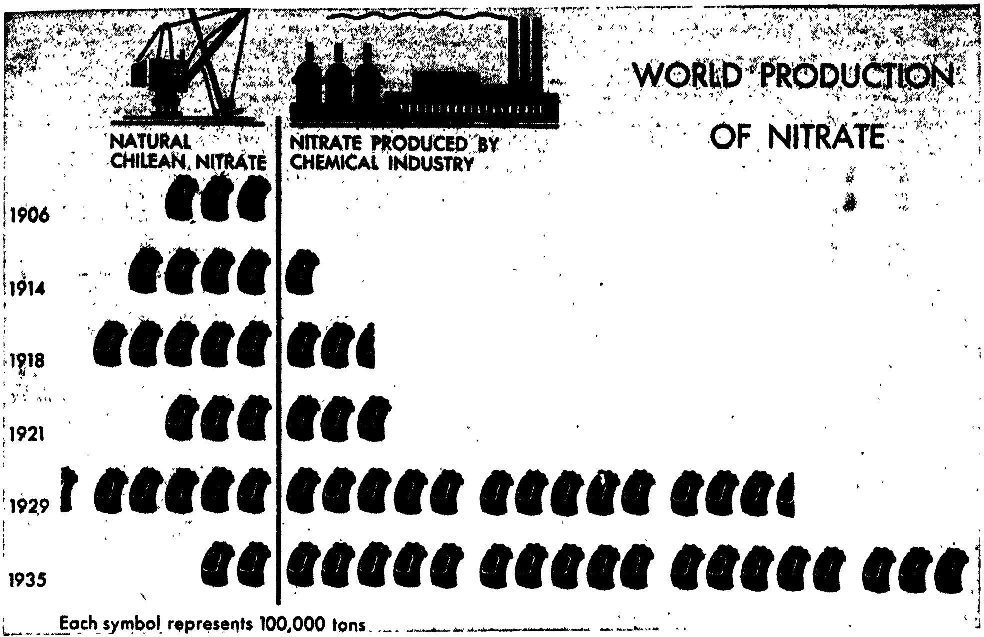
A copper converter, in which impurities are separated from the copper by streams of air which combine with the impurities to form oxides.

Courtesy, Anaconda Copper Mining Co.



Courtesy, Coordinator of Inter-American Affairs

Scene at a copper mine in Chile. Much of the copper found in Chile is refined with the aid of sulfuric acid, in a process called leaching. This reddish-gold metal has been called the electrician's metal, because it is used so extensively as a conductor of electricty. Nearly all of the telephone and telegraph wires that you see are made of copper; it does not rust and it can be used again and again. Much copper finds its way into two well-known alloys which you know as brass and bronze. Brass is an alloy of copper and zinc, while bronze is an alloy of copper and tin. Often, however, other metals are added so that the terms brass and bronze are rather general in nature.



Pictograph Corporation

Nitrate, known also as sodium nitrate or nitrate of soda, is valuable as fertilizer and as a source of nitric acid.

in Palestine for the recovery of magnesium chloride, among other chemicals, from the Dead Sea.

Copper. The chief use of this metal is as a conductor of electricity. Miles of wire and rods, thousands of kinds of electrical equipment, parts of clocks, all require copper.

Copper does not rust and can be used again and again. The principal mines in the United States are in Utah, Montana, Arizona and New Mexico.

The world's largest copper mine, the Chuquicamata, is in Chile; and Ecuador is known to have rich deposits.

More than half of Canada's copper production comes from the rich nickel-copper mines of Sudbury, Ontario.

The European countries must import some of their copper. Russia is probably the leading producer on the Continent now. There are deposits in the Urals, a region exceptionally rich in all kinds of minerals, and in Transcaucasia. In Kazakhstan there are large low-grade deposits.

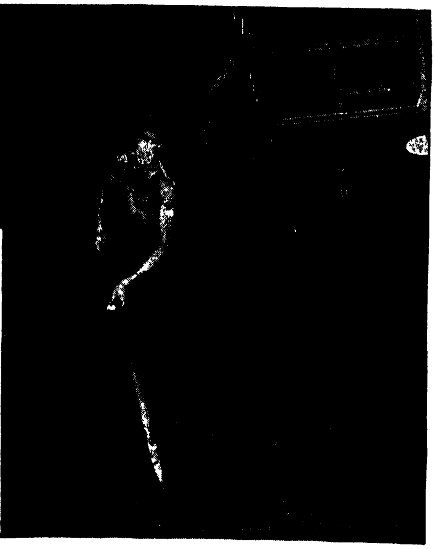
Lead. This mineral is frequently found in ores which also contain large quantities of silver or zinc or nickel. Such ores are treated to extract each of the metals. Probably the widest use of lead is in storage batteries; it is also important in certain kinds of paint, in

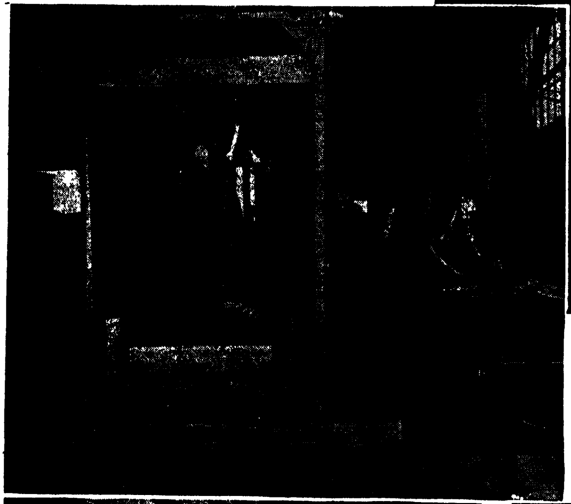
Courtesy, Coordinator of Inter-American Affairs

Nitrate being loaded into railroad cars for transportation to seaports. The chief wealth of Chile lies in her nitrate deposits; it is one of her main exports.

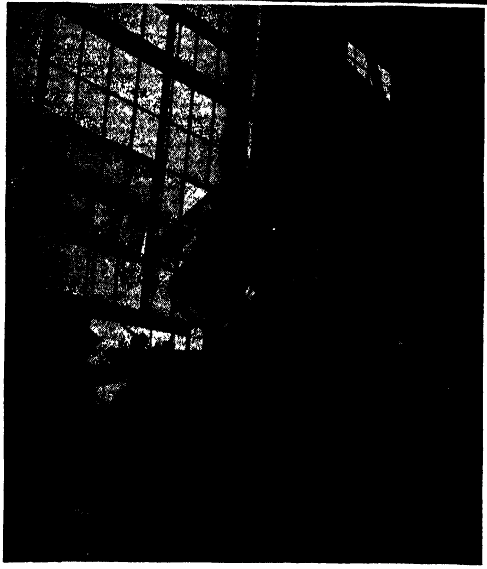
THE STORY OF TIN REFINING

A workman in the tin smelter, protected from harmful dust by a mask-like respirator, trims a huge stockpile of ore which has just been discharged from the crushers. A series of smelting operations will extract the pure tin. It will be used later in "tin cans," building materials, and in making brass and bronze.



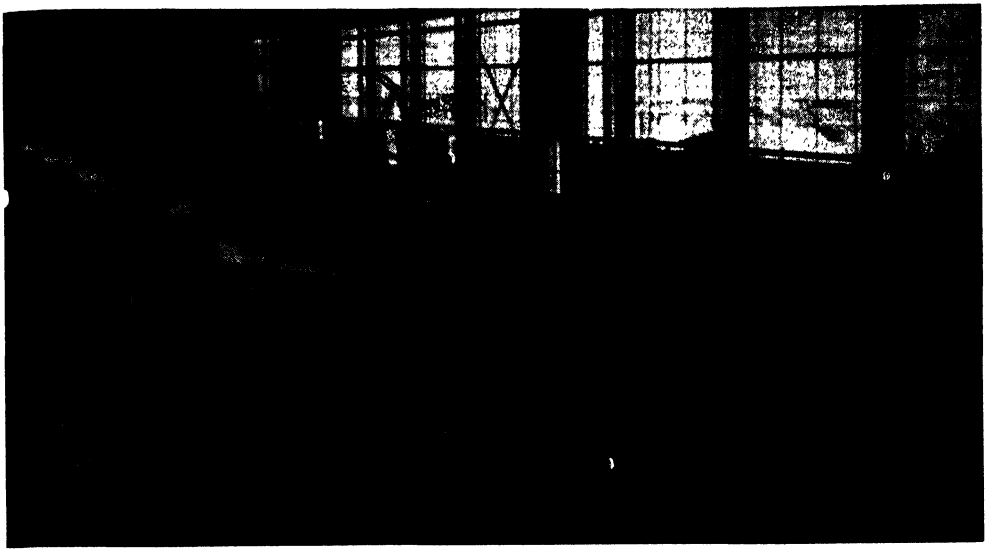


Emptying bags of raw tin ore onto a conveyor which feeds the crusher of a large smelting plant. The ore has been shipped in from South American mines. The crusher reduces the larger particles to uniform size, and discharges ore that is ready for the first stages of the smelting operation.

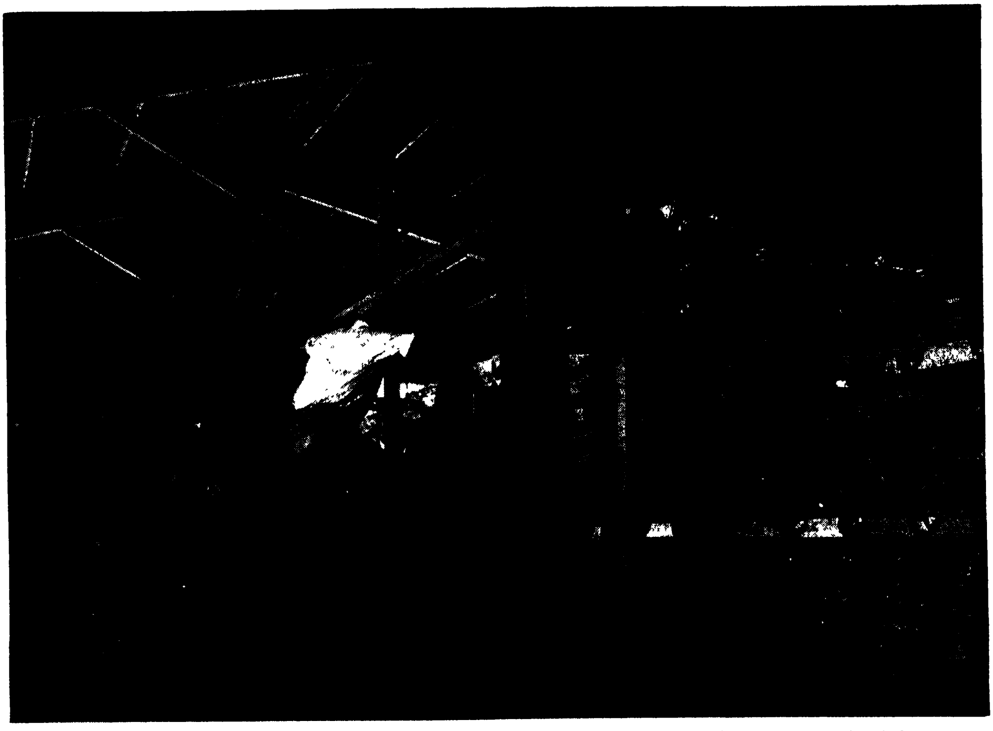


A sample of slag from one of the furnaces in the smelting plant is poured out for testing. Careful checks will be made to determine the tin content of the mass. After it has cooled, the sample will be sent to the plant laboratory, where a complete analysis will be conducted. The United States is the world's largest consumer of tin, although it has almost no deposits of its own from which to draw.

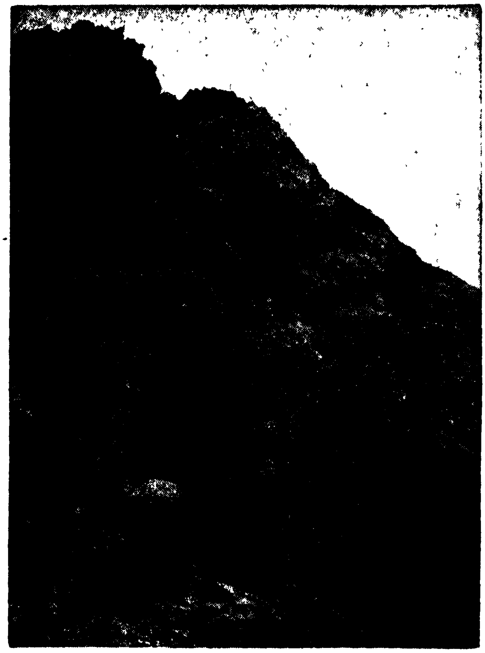
A laboratory assistant at the tin smelting plant performs a delicate operation in the analysis of slag. Results of the tests will show how much tin remains. Accurate laboratory control is an important reason for the fact that the percentage of metal recovery is remarkably high. Ore received from Bolivia, in South America, contains a higher amount of impurities than that imported from the Far East.



"Pot boilers" in the smelting plant. In these huge vats the pure metal is kept at a temperature of about 750 degrees F. until it is poured into molds. Tin, in the pure state, looks almost like silver. It has a fine white color, tinged with blue. The metal is very malleable, that is, it can be bent and molded easily. Water does not have much effect on tin, but after exposure to air the surface becomes dull and clouded. The "tinfoil" you are familiar with is not really tin at all. Actually, tinfoil is made mostly of lead.



Bars of pure tin stacked in the warehouse of the smelting plant. They are awaiting shipment. Each bar weighs about eighty pounds, and has a value of approximately fifty dollars. Much tin is used in the production of tin plate and in another material known as terneplate. Terneplate is sheeting of iron or steel that is covered with an alloy of tin and lead. It is used for building purposes and as roofing. Tin is also used in making cheap mirrors.



Courtesy, Coordinator of Inter-American Affairs

Manganese mining in Brazil. Russia has the best and most extensive deposits of this important metal.

the manufacture of high-powered gasoline, as shields in X-ray equipment and as a cable covering.

The most important resources in the United States are in Missouri, but Utah, Idaho, Colorado, Montana and Oklahoma also contribute large quantities.

Australia and Mexico have silver-lead ores. The rich ores of the Sudbury region of Canada contain lead as well as nickel. There are large reserves in South America, but production is small.

Italy is able to supply her own needs for lead much better than for most other metals. Production of lead is rapidly increasing in the Soviet Union, and it has reserves in Siberia.

Nickel and Cobalt. These minerals are considered together because they almost always are mixed in the same ores. Nickel is important in many alloys as it mixes readily and gives great hardness. It also resists heat and rust. Electroplating, the tough alloys for machines and engines, all require nickel. Cobalt is used in making pottery and china, for paints and linoleum, in cutting tools, and so on.

The Sudbury district in Ontario accounts for practically all the Canadian production. In New Caledonia the ore is unusual in being free from cobalt. Deposits similar to this have been found in Oregon, North Carolina and in Spain.

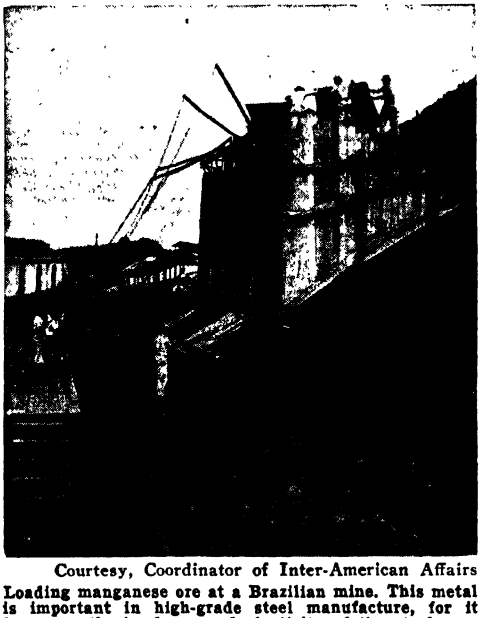
In the Soviet Union nickel comes from the Kola Peninsula (in the northwest) and the Urals. But the output thus far is barely sufficient for the country's own needs. Norway has well-developed deposits, and some of the ore from Canadian mines is sent there for refining.

Other sources of nickel which may be important some day are the Union of South Africa, Burma and the East Indies.

The Belgian Congo, French Morocco and Northern Rhodesia contribute about 75 per cent of the world production of cobalt. It is a by-product of lead-zinc mining in Burma. Canada usually follows these countries in cobalt production.

Tin. The United States is the largest consumer of tin. The metal is used for plating containers (what we call "tin cans"), in making alloys such as bronze and brass, for tubes and in galvanizing. Yet the United States has practically no tin deposits of its own. The richest resources are in the Far East, particularly Malaya.

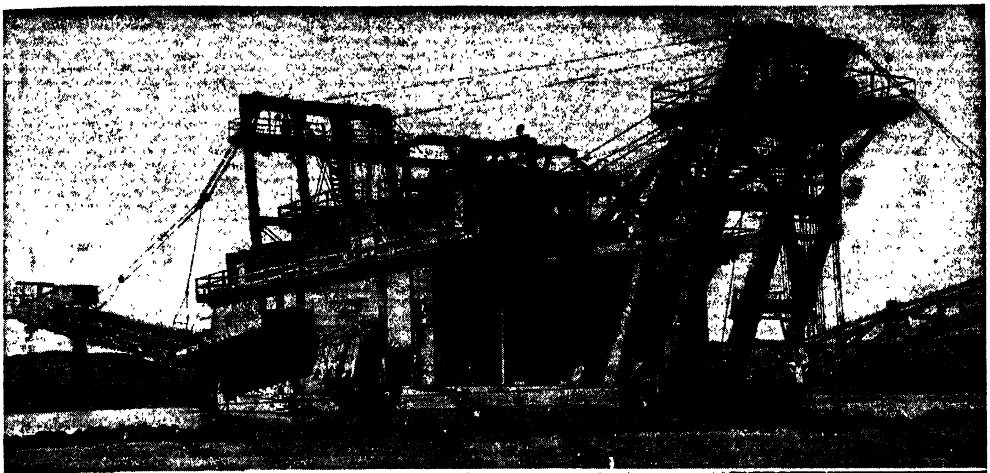
Though Bolivia usually ranks third in world production of tin ore, Bolivian ore has a much greater amount of impurities than that of the Far East. Argentina produces enough tin for her own needs at present.



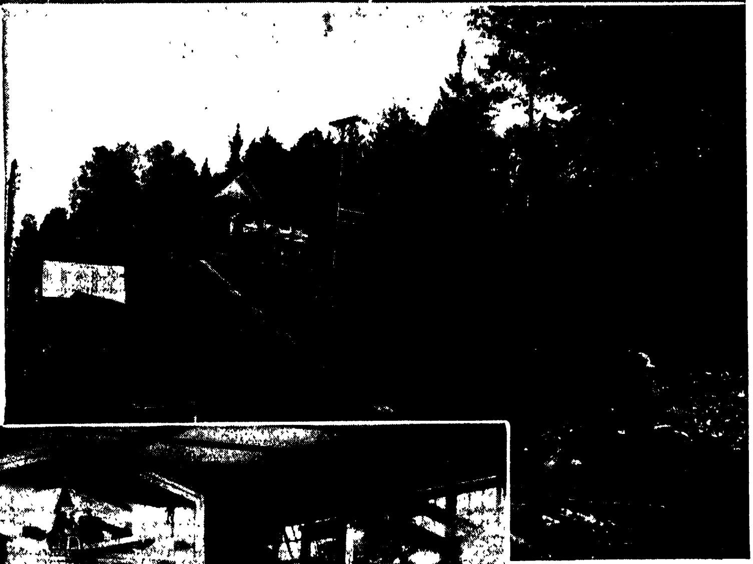
Courtesy, Coordinator of Inter-American Affairs

Loading manganese ore at a Brazilian mine. This metal is important in high-grade steel manufacture, for it increases the hardness and elasticity of the steel.

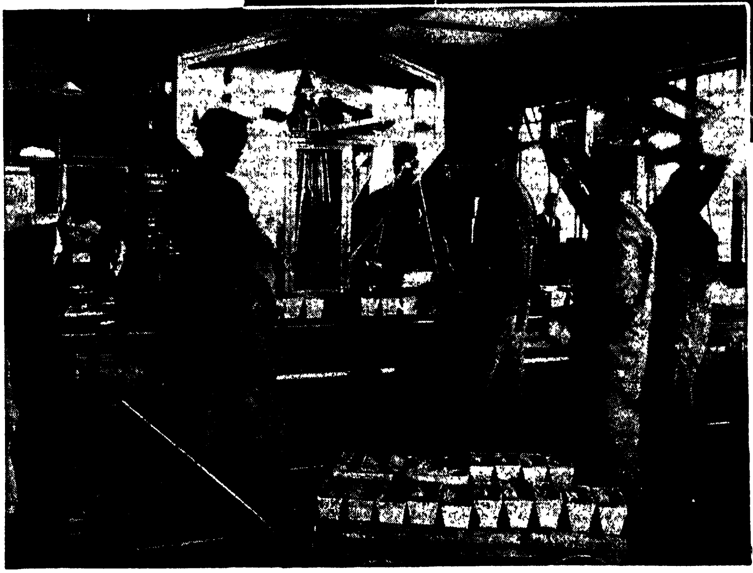
GOLD, THE METAL FIRST USED BY MAN



A gold-dredging machine at work. Something like a flat-bottomed boat, it scoops up gravel from under the water, and then separates the gold by washing and screening.



Hauling gold ore up into the sampling mill by means of a cable-driven car. This is at a gold mine near Larder Lake, Ontario, Canada. The province of Ontario contributes heavily to Canada's gold production.

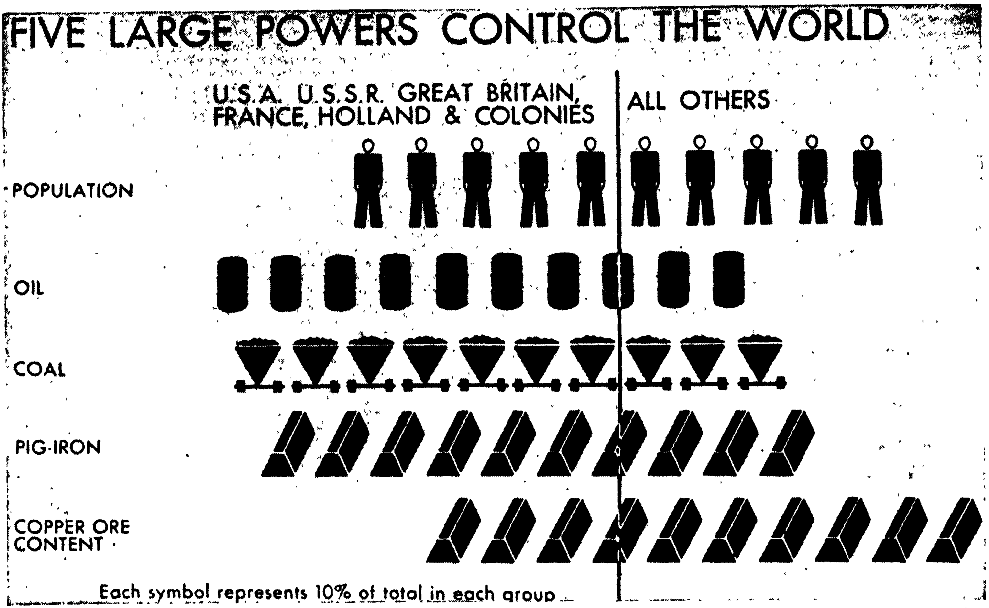


Weighing gold ingots at a mine in South Africa. Gold is found to some extent on every continent. South Africa usually produces about one-half of the world's supply of this metal.

Top picture—Courtesy, Chamber of Commerce, Sacramento, California

Middle picture—Courtesy, Canadian National Film Board

Bottom picture—Philip Gendreau, N. Y.



Pictograph Corporation

Tin ore is plentiful in the Chinese province of Yünnan. Other deposits, which may eventually prove rich, exist in eastern Siberia and Borneo.

Before the tin ore of the Far East was developed, the mines of Cornwall, England, were an important source. Then for many years they were neglected; but they were worked to some extent during World War II. Other sources in Europe are Portugal, Spain and Czechoslovakia.

Zinc. The principal use of this metal is for galvanizing sheets, tubes and wires to prevent rust. Almost half the zinc is used in this way in the United States. Brass, for hardware equipment and automobiles, for batteries, photographic equipment, paints and castings, also requires zinc.

In some years the United States accounts for more than two-fifths of world production of zinc. A large part comes from the tri-state region of Oklahoma, Kansas and Missouri. The mines of New Jersey and New York are next in importance; and substantial quantities are produced in Idaho, Utah, Montana, New Mexico, Tennessee, Virginia and Washington.

Though poor in most metals, Germany has extensive reserves of zinc.

Canada, Newfoundland and Australia together produce more zinc than Germany, but less than the United States. One of the largest deposits is in British Columbia, which also has lead-zinc ores. There are copper-zinc ores in Manitoba. Australia has enormous deposits of sulfide ores, which yield zinc, in New South Wales.

Though largely undeveloped, deposits of zinc ores exist in Rhodesia, the Belgian Congo, French Equatorial Africa, Morocco, Tunisia and Algeria.

In addition to Germany, Italy and Spain are sources of zinc in Europe.

Tungsten. This mineral has been called the king of metals. Were there enough of it, it might take the place of copper and even of steel. It has the highest melting point of any metal. We are familiar with it as the filament, or fine wire, in an electric-light bulb. However, its chief use is in the making of extremely hard cutting tools. Tungsten steel has been used for some years, but now an alloy of tungsten and carbon has been developed. This is called tungsten carbide, or cemented carbide. In nearly all carbides as made today, there is six to twelve per cent cobalt added to the carbide. It is not added as a hardening agent, though it does have a tendency to make the carbides tougher and wear longer. A diamond is the only substance harder than tungsten carbide. A pound of tungsten will go much farther in industrial production in this form than in the form of high-speed steel—in some cases 100 to 1. Wolframite is the chief tungsten ore.

Spain has some wolframite. Tungsten ores are found in Asia, in China, Burma and Siberia. Small quantities are produced in Siam, Korea and Malaya.

Though the United States frequently ranks third in world production of tungsten ore, it must import about 75 per cent of its requirements. Efforts have been increased to find more at home. Nevada is the principal producing state.

While Canada apparently has no wolframite, it does have another mineral, scheelite, which contains tungsten. The deposits of scheelite are now being explored.

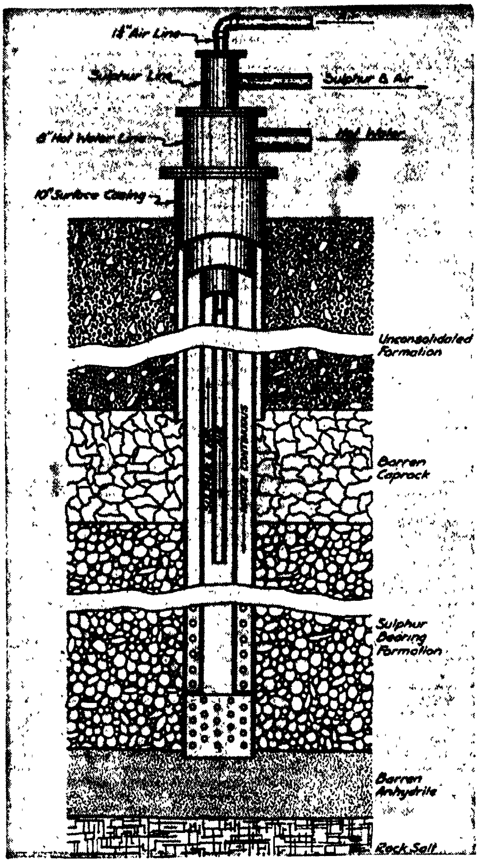
In South America, the Bolivian deposits are capable of much greater development, and Peru is known to have large reserves.

Chromium. Perhaps some parts of your bicycle are plated with this gleaming hard metal. It has great resistance to rust and acids, and it gives toughness and lasting power to cutting tools and the inner parts of engines. Stainless steel contains 18 per cent chromium. Furnace linings and leather-tanning also require chromium.

Chrome ore of good grade is not very widely distributed. The United States consumes large quantities, but until the war it imported most of its requirements. This was less expensive than treating the poor grades at home, mostly in the western states. However, some high-grade ore has been found in Alaska.

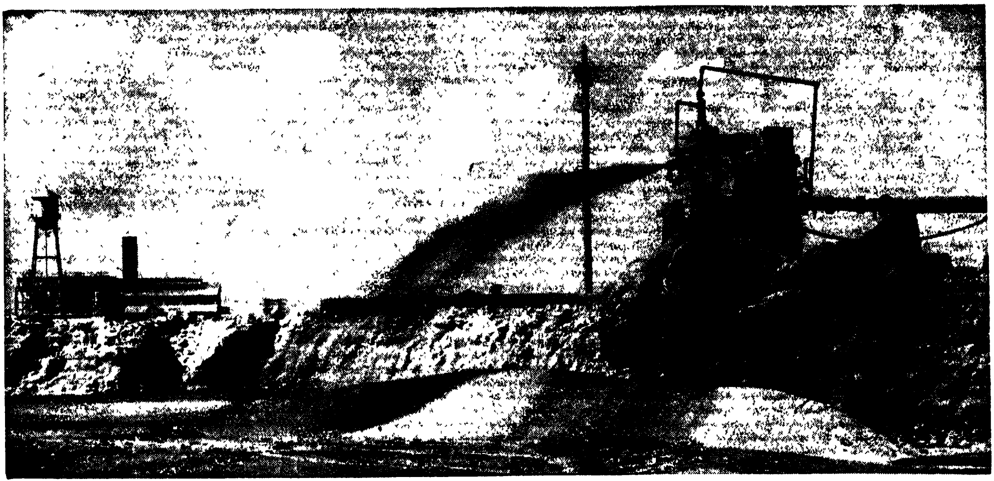
Greece, Cyprus, Yugoslavia, Albania and Bulgaria are all known to have deposits, but they have been developed only in Greece to any extent.

The chrome ore of Latin America is almost



Courtesy, Freeport Sulphur Company

Cross section of a sulfur well, showing earth layers.



Courtesy, Freeport Sulphur Company

Molten sulfur being sprayed into a storage vat at a mine in Louisiana. The sulfur is melted underground by pumping hot water into the deposit. It is then piped to the surface where it is allowed to cool and solidify in huge bins.

WORLD PRODUCTION

Countries	Coal	Petroleum	Iron Ore	Bauxite	Mag-nesium	Copper Ore	Lead	Nickel	Tin
NORTH AMERICA									
United States	581,783	1,388,308	75,000	446	5.7	661	331		
Canada	18,136	10,403				276	182	96.0	
Mexico	545	37,025				44	274		
Cuba			?						
SOŬTH AMERICA									
Chile	1,937		1,608			339			
Brazil	1,408		360						
Venezuela	3	162,000							
Argentina		23,900					10		1.5
Peru	107	13,275					28		
Colombia	331	10,930							
Guiana				1,315					
Bolivia		335							37
Trinidad		20,219							
AFRICA									
Union of So. Africa	17,176								
Southern Rhodesia	1,118								
Egypt		7,600							
Algeria	13		3,105						
Spanish Morocco			1,342						
Northern Rhodesia						255			
Belgian Congo	42					148			7
Tunisia							24		
Gold Coast									
French Morocco	116								
Nigeria									11
EUROPE									
Soviet Union**	34,261	228,900	26,530	300	1.5	144	55	2.5	
France	51,000		33,137	700	2.0		42		
German (including Austria)	433,569	12,435	13,000	20	19.0	30	182		
United Kingdom	237,700		12,050		6.5		10		2
Poland	38,114	3,891					20		
Czechoslovakia	30,517		1,836						
Belgium	29,847						94		
Netherlands	13,058								
Hungary	10,625	3,805		700					
Rumania	2,585	38,100		10					
Sweden			13,928						
Luxemburg			5,141						
Spain	6,957		2,516				36		
Norway			1,425					1.3	
Greece				187				1.2	
Yugoslavia				150		64			
Switzerland					.7				
Italy	3,083			530	.5		34		
Portugal									
Cyprus									
Bulgaria									
ASIA									
Japan	45,666	7,800			4.0	104	10		
India	28,214	2,550	2,788						
China	27,116								6
Iran		75,800							
Iraq		14,300							
Bahrein Islands		7,074							
Arabia		6,000							
Burma		2,000					80		5
Malaya	794		2,518	64					80
Thailand (Siam)									16
Turkey	2,847								
Korea (Chosen)	4,481								
OCEANIA									
Australia	17,461		2,281			20	226		
New Zealand	2,380								
Neth. East Indies	1,781	15,650							40
Borneo		7,047							
Philippine Islands	47		1,192						
New Caledonia								12.0	
New Guinea									
Tasmania									
Fiji Islands									

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* Production of petroleum is given in thousands of barrels; of gold and silver, in thousands of fine ounces; of mercury, in flasks (75 pounds production after treatment of the ores. ** Figures for the Soviet Union, under Europe, include both European and Asiatic territory.

OF CHIEF MINERALS*

Zinc	Tungsten Ore	Chromite	Manganese Ore	Mercury	Gold	Silver	Sulfur		Countries
							Pyrites	Native Sulfur	
									NORTH AMERICA
460	5.0	4	41	17,991	4,863	68,287	627	2,459	United States
159		4			5,323	23,816	207		Canada
38				11,653	883	82,640			Mexico
		67	124						Cuba
									SOUTH AMERICA
			19		341			24	Chile
		3	222		319				Brazil
					147				Venezuela
	1.0								Argentina
					288	18,450		1	Peru
					631				Colombia
									Guiana
	5.0							4	Bolivia
									Trinidad
									AFRICA
		160	552		14,047	1,292	36		Union of So. Africa
		139			826		27		Southern Rhodesia
			153						Egypt
							44		Algeria
									Spanish Morocco
13									Northern Rhodesia
					?	2,085			Belgian Congo
									Tunisia
			329		886				Gold Coast
			87						French Morocco
									Nigeria
									EUROPE
65	?	350	2,273	8,700	?	8,022	?		Soviet Union
60							147		France
200				1,750		?	465		Germany (including Austria)
50									United Kingdom
118							92		Poland
				2,900					Czechoslovakia
									Belgium
									Netherlands
			22						Hungary
			60		131		11		Rumania
			6		198	1,123	192		Sweden
									Luxemburg
11	?			53,441			?		Spain
45							1,028		Norway
		57	11				244		Greece
4		60	6				150		Yugoslavia
									Switzerland
34			48	66,748			930	337	Italy
	5.0						558		Portugal
		6					404		Cyprus
		4	3						Bulgaria
									ASIA
46						10,100		155	Japan
		50	1,068						India
	15.0								China
									Iran
									Iraq
									Bahrein Islands
									Arabia
?	6.0					6,175			Burma
	.6		32						Malaya
									Thailand (Siam)
		192						2	Turkey
						2,673			Korea (Chosen)
									OCEANIA
72					1,191	13,000	55		Australia
					179				New Zealand
								16	Neth, East Indies
									Borneo
		127	49		1,099	1,396			Philippine Islands
		52							New Caledonia
					275				New Guinea
						1,278			Tasmania
					115				Fiji Islands

each); of all the other minerals, in thousands of metric tons (1 metric ton = 2,204 pounds). On lead, nickel, zinc and tin, the figures are for entirely of low grade. Cuba produces the most. The Brazilian deposits are extensive, but they are in a remote section of the country.

Manganese. This metal is used chiefly in the production of ordinary steel, as high-grade, or ferro-grade, manganese is necessary to remove the sulfur and oxygen in the iron ore. Each ton of steel requires fourteen pounds of manganese. Yet, with the exception of the Soviet Union, the leading steel-making countries—the United States, Great Britain, Germany, France, Italy and Japan—do not have much manganese ore of high grade, or ferro-grade.

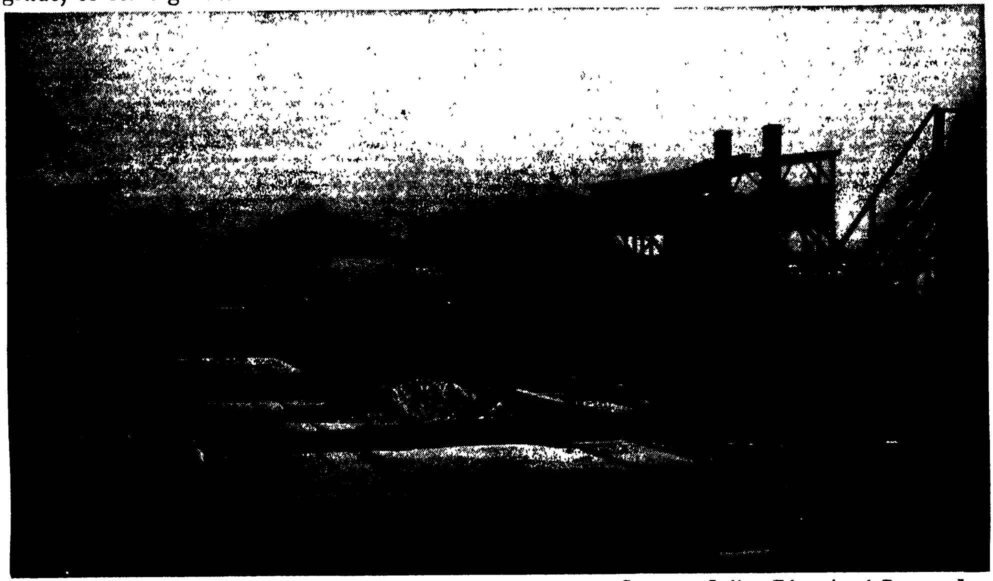
While there are millions of tons of ore in the United States, it is poor ore and production is largely for use in dry batteries. Ferro-grade manganese ore must be imported.

The finest manganese to be found anywhere is at Chiatury, Georgia, in the Caucasus; and there are rich deposits in other localities of the Caucasus and in the Ukraine.

Beryllium. This is the fourth lightest metal, and production is a growing industry. Alone, it has little value; but its strength in alloys is amazing. A spring made of phosphor bronze will break after 400,000 vibrations; the best steel spring will break after 2,000,000 or 3,000,000 vibrations; but a beryllium-copper or beryllium-nickel spring will stand more than 20,000,000,000 (twenty billion!) vibrations before breaking.

Beryl, the mineral from which beryllium is obtained, exists in limited quantities in many countries. Thus far, however, development has begun only in Brazil, Argentina, Australia, Norway, India, the Union of South Africa and the United States. Brazil and Argentina together probably produce more than the rest of the world now.

Mercury. Though mercury is produced and used only in rather small amounts, this heavy silvery liquid metal is of the greatest importance to all of us. We know it in thermometers, and it has many uses in other scientific instruments, in medicine, in the manufacture of chemicals, storage batteries and paints. It gives a brilliant red color, vermilion, to pigment.



Courtesy, Iodine Educational Bureau, Inc.

An iodine plant at Pedro de Valdivia, in Chile. Some iodine is found in seaweeds and in the waters flowing from oil wells, but the major porton of the world's supply is produced in the process of purifying soda nitrate in Chile.

Although mercury is sometimes found in the pure state, it is usually obtained from cinnabar, an ore which is a compound of mercury and sulfur.

Italy and Spain dominate world production, the largest reserves and highest grade ore being found in Spain. The Almaden mine is famous.

In the United States the greatest amounts come from California, Oregon, Nevada and Arkansas. The most important source of mercury in the British Empire is in British Columbia, Canada. One mine here has developed into the largest mine in North America;

and production is increasing at a rapid rate. Mercury ores also occur over a wide area in Mexico.

Gold. The chief importance of gold nowadays is for jewelry and decorative objects. Once it was largely used for coins; and it is still thought of as a basis for money. Over the centuries the world has been adding to its store of the yellow metal, and in recent years much less has been mined.

At various times the Union of South Africa has supplied half the year's total world production. But no continent is without some gold deposits. Outside of Russia, Europe is the poorest. Canada and Alaska are the biggest producers in North America.

Silver. This metal has usually been classed and used as a precious metal, although not nearly so valuable as gold. During the war, it was pressed into service as an alloy material and as a substitute for scarce copper. Silver is the best conductor of electricity. It is widely distributed in the earth's crust, but the biggest producers are all on this side of the Atlantic Ocean—Mexico, the United States, Canada and Peru.

Sulfur. There is hardly an article made today that does not require the use of sulfur at some stage in its manufacture. Most often the sulfur is used in the form of sulfuric acid. Chemicals, fertilizers, insecticides, pulp and paper, explosives, dyes, coal-tar products, rubber, paint and varnish, oil refining, steel pickling, textiles and food products head the long list.

The element is obtained in three ways: from pyrites, a mineral in which the sulfur is combined with other elements; from native or free sulfur in which it is just mixed with the soil; and as a by-product of coke manufacturing, of industrial gases or other mining. In 1937, 52 per cent was obtained from pyrites, 37 per cent from native sulfur and 11 per cent as a by-product.

Sulfur is fairly well distributed, but world markets are largely supplied by the United States and Italy. There are very rich deposits of native sulfur in Texas and Louisiana. The fairly large Japanese output is consumed at home.

Mica. Perhaps you know mica as the "glass" in the window of the door of an old-fashioned stove. A more important use today, since the mineral is a non-conductor of electricity, is as an insulating material or condenser in electrical appliances such as radios. Another important use is in the spark plugs for automobiles. For most purposes, mica must be in the form of thin, clear sheets. More than half of the sheet mica is used as splittings, that is, the raw material for built-up board, or "micanite"; but in many electrical devices only shapes cut out of the natural sheets will serve.

Courtesy, Handy & Harman, New York

Rolling out a sheet of sterling silver. Sterling is not pure silver; it is composed of ninety-two and a half percent silver and seven and a half percent copper.

While the crude mineral naturally splits rather easily, considerable skill and time are required to make it cleave in the most useful form. Thus far machinery has not been found very satisfactory for this work. A great deal of the mineral must be wasted, although as ground or powdered mica the scrap has some value in the manufacture of lubricants and fireproof paint.

For a long time India has dominated world production of sheet mica, because India has both rich deposits and experienced, cheap labor. Canada, a possible large source, particularly in Quebec, has had some success in splitting amber mica mechanically. But the mica of India, called muscovite or "white" mica, has a somewhat different composition. Madagascar is practically the only other country producing splittings from amber mica, in important quantities.

The United States has large deposits of mica, especially in North Carolina, but produces only a small amount of sheet mica. The war quickened development there, however, as well as in Canada, Mexico, Brazil and Argentina. The Transvaal, in Africa, is the only other source of any importance at present.

Potash. By far the most important use of potash is as a fertilizer. Growing plants consume the potash salts in the soil, and they must be restored. Potash is also used to some extent in the chemical industry.

For many years Germany had practically a monopoly on world production. But the United States is now almost self-sufficient. Potash is obtained from natural brines (the salt water of lakes and wells) and salt beds, in New Mexico, California and Utah.

Norway has experimented with the recovery of potash salts from sea water. This is a growing industry in Palestine, where the water of the Dead Sea is treated. Immense deposits of potash are believed to exist in central Asia.

Diamonds. Diamond is the hardest substance known, and thus has extremely important industrial uses. The best stones, of course, are used in jewelry; but in industry poor color and imperfections do not matter. Diamonds are used in tools for finishing and cutting tough materials, in drawing wire, for drilling and cutting glass and porcelain, for etching and engraving, as well as for cutting gem stones. The automobile and aircraft industries are large consumers of industrial diamonds.

Africa is the great diamond continent. The Belgian Congo now leads in the world production of industrial diamonds. The Gold Coast and the Union of South Africa rank second and third.

For the last few years production has been increasing in Brazil and Venezuela. It is believed that there are several rich deposits south of the Orinoco River in Venezuela.

There is a possible source of industrial diamonds within the United States. Deposits containing excellent diamonds have been found in Arkansas, but they have not yet been brought into actual production.

THE NEXT STORY OF THE EARTH IS ON PAGE 7222.

Courtesy, Anaconda Copper Mining Company

The frame at the head of a copper mine in the Butte area of Montana. Many of the mines in this area were originally opened as silver mines, but copper deposits were found instead of silver, at depths of about 150 feet. Mines are of two general types: open pit and underground. The picture shows the head of an underground mine.

POETRY OF CANADA

Illustrated by Thoreau MacDonald

Jacques Cartier

By THOMAS D'ARCY MCGEE
(1825-1888)

IN the seaport of St. Malo, 'twas a smiling
morn in May,
When the Commodore Jacques Cartier to the
westward sailed away;
In the crowded old Cathedral all the town
were on their knees,
For the safe return of kinsmen from the
undiscovered seas;
And every autumn blast that swept o'er
pinnacle and pier,
Filled manly hearts with sorrow, and gentle
hearts with fear.

A year passed o'er St. Malo—again came
round the day
When the Commodore Jacques Cartier to the
westward sailed away;
But no tidings from the absent had come the
way they went,
And tearful were the vigils that many a
maiden spent;
And manly hearts were filled with gloom, and
gentle hearts with fear,
When no tidings came from Cartier at the
closing of the year.

But the earth is as the future, it hath its
hidden side,
And the Captain of St. Malo was rejoicing
in his pride;
In the forests of the North—while his
townsmen mourned his loss—
He was rearing on Mount Royal the
fleur-de-lys and cross;
And when two months were over, and added
to the year,
St. Malo hailed him home again, cheer
answering to cheer.

He told them of a region, hard, iron-bound,
and cold,
Nor seas of pearl abounded, nor mines of
shining gold;
Where the wind from Thule freezes the word
upon the lip,
And the ice in Spring comes sailing athwart
the early ship;
He told them of the frozen scene, until they
thrilled with fear,
And piled fresh fuel on the hearth to make
them better cheer.

But when he changed the strain—he told
how soon are cast,
In early Spring, the fetters that hold the
waters fast;
How the wintry causeway, broken, is drifted
out to sea,
And the rills and rivers sing with pride the
anthem of the free;
How the magic wand of Summer clad the
landscape to his eyes,
Like the dry bones of the just when they
wake in Paradise.

He told them of the Algonquin braves—the
hunters of the wild;
Of how the Indian mother in the forest rocks
her child;
Of how, poor souls! they fancy in every living
thing
A spirit good or evil, that claims their
worshipping;
Of how they brought their sick and maimed
for him to breathe upon;
And of the wonders wrought for them,
through the Gospel of St. John.

He told them of the river whose mighty
current gave
Its freshness for a hundred leagues to
Ocean's briny wave;
He told them of the glorious scene presented
to his sight,
What time he reared the cross and crown
on Hochelaga's height;
And of the fortress cliff that keeps of
Canada the key;—
And they welcomed back Jacques Cartier
from his perils o'er the sea.

Ole Tam on Bord-a Plouffe[*]

By William H. Drummond (1854-1907)

I lak on summer ev'ning, w'en nice cool win' is blowin'
An up above ma head, I hear de pigeon on de roof,
To bring ma chair an' sit dere, an' watch de current flowin'
Of ole Riviere des Prairies as she pass de Bord-a Plouffe.

But it seem dead place for sure now, on shore down by de lan'in'—
No more de voyageurs is sing lak dey was sing alway—
De tree dey're commence growin' w'ere shaintee once is stan'in',
An' no one scare de swallow w'en she fly across de bay.

I don't lak see de reever she's never doin' notin'
But passin' empty ev'ry day on Bout de l'ile below—
Ma ole shaloup dat's lyin' wit' all its timber rottin'
An' tam so change on Bord-a Plouffe since forty year ago!

De ice dat freeze on winter, might jus' as well be stay dere,
For w'en de spring she's comin' de only t'ing I see
Is two, t'ree piqnique feller, hees girl was row away dere,
Don't got no use for water now, on Riviere des Prairies.

'Twas diff'rent on den summer you couldn't see de reever,
Wit' saw-log an' squar' timber raf', mos' all de season t'roo—
Two honder man an' more too—all busy lak de beaver,
Ah' me! I'm wan de pilot for ronne 'em down de "Soo."
Don't 'member lak I use to, for now I'm gettin' ole, me—
But still I can't forget Bill Wade, and Guillaume Lagassé,
Joe Monferrand, Bazile Montour—wit' plaintee I can't tole, me,
An' king of all de Bord-a Plouffe, M'sieu Venance Lemay.

Lak small boy on hees lesson, I learn de way to han'le
Mos' beeges' raf' is never float upon de Ottawaw.
Ma fader show me dat too, for well he know de channel,
From Dutchman Rapide up above to Bout de l'ile en bas.

He's smart man too, ma fader, only t'ing he got de bow-leg
Ridin' log w'en leetle feller, mebbe dat's de reason why,
All de sam', if he's in hurry, den Bagosh! he's got heem no leg
But wing an' fedder lak oiseau, was fly upon de sky!

O dat was tam we're happy, an' man dey're always singing',
For if it's hard work on de raf', w'y dere's your monee sure!
An' ev'ry summer evenin', ole Bord-a Plouffe she's ringin'
Wit' "En Roulant ma Boulè" an' "J'aimerais toujours."

Dere dey're comin' on de wagon! fine young feller ev'ry wan too,
Dress im up de ole tam fashion, dat I lak for see encore;
Yellin' hooraw! t'roo de village, all de horse upon de ronne too,
Ah poor Bord-a Plouffe! she never have dem tam again no more!

Very offen w'en I'm sleepin', I was feel as if I'm goin'

[*] From The Habitant, copyright 1897, 1925, by G. P. Putnam's Sons.

Down de ole Riviere des Prairies on de raf'
de sam as den—
An' ma dream is only lef' me, w'en de rooster
commence crowin'
But it can't do me no harm, 'cos it mak me
young again.

An' upon de morning early, w'en de reever
fog is clearin'
An' sun is makin' up hees min' for drive away
de dew,
W'en young bird want hees breakfas', I wak'
an' t'ink I'm hearin'
Somebody shout "Hooraw, Bateese, de raf
she's wait for you."

Dat's voice of Guillaume Lagassé was call me
on de morning,
Jus' outside on de winder w'ere you look
across de bay,
But he's drown upon de Longue "Soo," wit'
never word of warning
An' green grass cover over poor Guillaume
Lagassé.

I s'pose dat's meanin' somet'ing—mebbe
I'm not long for stay here,
Seein' all dem strange t'ings happen—dead
frien' comin' roun' me so—
But I'm sure I die more happy, if I got jus'
wan more day here,
Lak we have upon de ole tam Bord-a Plouffe
of long ago!

For Justice

By BERNARD FREEMAN TROTTER
(1890-1917)

OH, to have died that day at Langemarck!
In one fierce moment to have paid it all—
The debt of life to Earth, and Hell, and
Heaven!
To have perished nobly in a noble cause!
Untarnished, unpolluted, undismayed
By the dank world's corruption, to have
passed,
A flaming beacon-light to gods and men!
For in the years to come it shall be told
How these laid down their lives, not for
their homes,
Their orchards, fields, and cities: "They
were driven
To slaughter by no tyrant's lust for power;
Of their free manhood's choice they crossed
the sea
To save a stricken people from its foe.
They died for Justice—Justice owes them
this:
That what they died for be not overthrown."

On the Road

By CHARLES G. D. ROBERTS (1860-1943)

Sir Charles G. D. Roberts belonged to a famous literary family. He wrote wonderful stories of animal life.

EVER just over the top of the next brown
rise
I expect some wonderful thing to flatter my
eyes.
"What's yonder?" I ask of the first wayfarer
I meet,
"Nothing!" he answers, and looks at my
travel-worn feet.

"Only more hills and more hills, like the
many you've passed,
With rough country between, and a poor
enough inn at the last."
But already I am a-move, for I see he is
blind,
And I hate that old grumble I've listened to
time out of mind.

I've tramped it too long not to know there
is truth in it still,
That lure of the turn of the road, of the
crest of the hill.
So I breast me the rise with full hope, well
assured I shall see
Some new prospect of joy, some brave venture
a tip-toe for me.

For I have come far, and confronted the calm
and the strife.
I have fared wide, and bit deep in the apple
of life.
It is sweet at the rind, but oh, sweeter still
at the core;
And whatever be gained, yet the reach of the
morrow is more.

At the crest of the hill I shall hail the new
summits to climb,
The demand of my vision shall beggar the
largess of time.
For I know that the higher I press, the wider
I view,
The more's to be ventured and visioned, in
worlds that are new.

So when my feet, failing, shall stumble in
ultimate dark,
And faint eyes no more the high lift of the
pathway shall mark,
There under the dew I'll lie down with my
dreams, for I know
What bright hill-tops the morning will show
me, all red in the glow.

The Walker of the Snow

By Charles Dawson Shanley
(1811-1875)

In this beautiful ballad the poet dramatizes a folk legend of the Canadian fur trappers which is like those of the ancient forest lands of Europe.

Speed on, speed on, good Master!
The Camp lies far away;
We must cross the haunted valley
Before the close of day.

How the snow-blight came upon me
I will tell you as we go,—
The blight of the Shadow Hunter,
Who walks the midnight snow.

To the cold December heaven
Came the pale moon and the stars,
As the yellow sun was sinking
Behind the purple bars.

The snow was deeply drifted
Upon the ridges drear,
That lay for miles around me
And the camp for which we steer.

'Twas silent on the hillside,
And by the sombre wood,
No sound of life or motion
To break the solitude,

Save the wailing of the moose-bird
With a plaintive note and low,
And the skating of the red leaf
Upon the frozen snow.

And I said, "Though dark is falling,
And far the camp must be,
Yet my heart it would be lightsome
If I had but company."

And then I sang and shouted,
Keeping measure, as I sped,
To the harp-twang of the snow-shoe
As it sprang beneath my tread.

Not far into the valley
Had I dipped upon my way,
When a dusky figure joined me
In a capuchon of gray,

Bending upon the snow-shoes,
With a long and limber stride;
And I hailed the dusky stranger
As we traveled side by side.

But no token of communion
Gave he by word or look,
And the fear-chill fell upon me
At the crossing of the brook.

For I saw by the sickly moonlight
As I followed, bending low,
That the walking of the stranger
Left no footmarks on the snow.

Then the fear-chill gathered o'er me,
Like a shroud around me cast,
As I sank upon the snow-drift
Where the Shadow Hunter passed.

And the other trappers found me,
Before the break of day,
With my dark hair blanched and whitened
As the snow in which I lay.

But they spoke not as they raised me;
For they knew that in the night
I had seen the Shadow Hunter,
And had withered in his blight.

Sancta Maria speed us!
The sun is falling low,—
Before us lies the valley
Of the Walker of the Snow!

From Dunkirk*

By E. J. PRATT (1883-)

FROM Dover to Dunkirk,
From Dunkirk to Ramsgate,
And back to the dunes.

. . . .

The great birds, carrying under their wings
The black distorted crosses,
Plunged, straightened out,
Laid their eggs in air,
Hatched them in fountains of water,
In craters of sand,
To the leap of flame,
To the roar of avalanche.

And in those hours,
When Death was sweating at his lathe,
When heads and legs and arms were blown from their trunks,
When the seventh day on the dunes became the eighth,
And the eighth slumped into the dawn of the ninth,
When the sand's crunch and suck under the feet
Were sounds less to be endured than the crash of bombs
In that coma and apathy of horror—
It was then that the feel of a deck,
The touch of a spar or a halyard,
Was like a hold on the latch of the heart of God.
It's the Navy's job!
It's their turn now,
From the Beach to the ports.
Let the Stukas break their bloody necks on the Mole;
Let the fires scorch the stars—
For now, whether on the burnished oak of the cabins,
Or on the floor-boards of the punts,
Or in the cuddies of the skiffs,
Sleep at last has an even game with Death.

The blessed fog—
Ever before this day the enemy,
Leagued with the quicksands and the breakers—
Now mercifully masking the periscope lenses,
Smearing the hair-lines of the bomb-sights,
Hiding the flushed coveys.
And with it the calm on the Channel,
The power that drew the teeth from the storm,
The peace that passed understanding,
Soothing the surf, allaying the lop on the swell.
Out of the range of the guns of Nieuport,
Away from the immolating blasts of the oil-tanks,
The flotillas of ships were met by flotillas of gulls
Whiter than the cliffs of Foreland;
Between the lines of the Medway buoys
They steamed and sailed and rowed,
Back to the roadsteads, back to the piers
Inside the vigilant booms,
Back to the harbours,
Back to the River of London, to England,
Saved once again by the tread of her keels.

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*From Dunkirk, by E. J. Pratt: reprinted by permission of The Macmillan Company of Canada Ltd., and Alfred A. Knopf, Inc.

Song of the Golden Sea*

By Jean Blewett (1862-1934)

Sing, ye ripening fields of wheat,
Sing to the breezes passing by,
Sing your jubilant song and sweet,
Sing to the earth, the air, the sky!

Earth that held thee and skies that kissed
Morning and noon and night for long,
Sun and rain and dew and mist,
All that has made you glad and strong!

The harvest fields of the far, far west
Stretch out a shimmering sea of gold!
Every ripple upon its breast
Sings peace, and plenty, and wealth untold!

Far as the eye can reach it goes,
Farther yet, till there seems no end,
Under a sky where blue and rose
With the gold and turquoise softly blend.

Here, where sweep the prairies lone,
Broad and beautiful in God's eyes,
Here in this young land, all our own,
The garner-house of the old world lies.

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I Sat Among the Green Leaves*

By Marjorie L. C. Pickthall (1883-1922)

I sat among the green leaves, and heard the nuts falling,
The broadred butterflies were gold against the sun,
But in between the silence and the sweet birds calling
The nuts fell one by one.

Why should they fall and the year but half over?
Why should sorrow seek me and I so young and kind?
The leaf is on the bough and the dew is on the clover,
But the green nuts are falling in the wind.

Oh, I gave my lips away and all my soul behind them.
Why should trouble follow and the quick tears start?
The little birds may love and fly with only God to mind them,
But the green nuts are falling on my heart.

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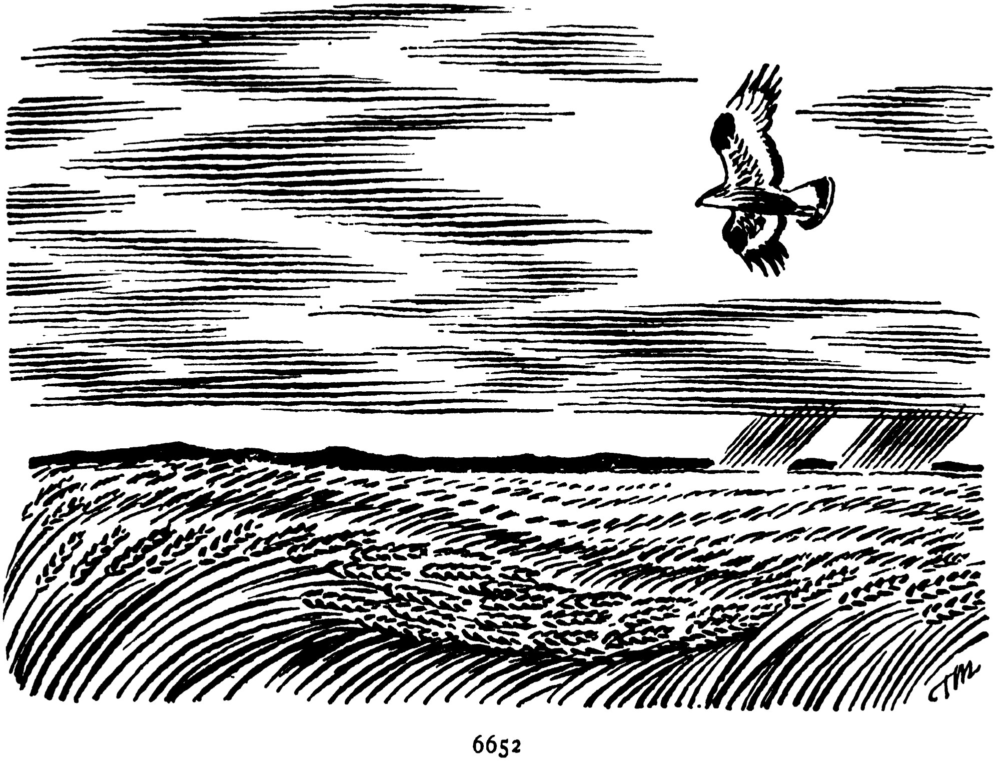


October

From A CANADIAN CALENDAR

By JOHN MURRAY GIBBON (1875-)

Falling, falling leaves!
  And indoors
Cellars sweet-smelling with apples,
Fair hands busy with canning and stores for
    the winter.

Morning in frosty apron,
Noon in a bonnet of blue,
Night with a cool dark cloak overtaking
    the day.

Once in a while a sky a-swirl with rain
And winds in wild cavalcades,
But always,
On the greensward,
Falling, falling leaves!

The Gift

By BLISS CARMAN (1861-1929)

I said to Life, "How comes it,
    With all this wealth in store
Of beauty, joy and knowledge,
    Thy cry is still for more?

"Count all the years of striving
    To make thy burden less,
The things designed and fashioned
    To gladden thy success!

"The treasures sought and gathered
    Thy lightest whim to please;
The loot of all the ages,
    The spoil of all the seas!

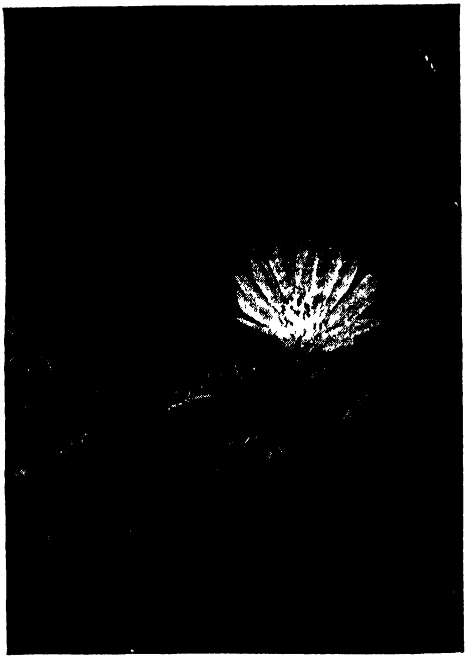
"Is there no end of labor,
    No limit to thy need?
Must man go bowed for ever
    In bondage to thy greed?"

With tears of pride and passion,
    She answered, "God above!
I only want the asking
    To spend it all for love!"

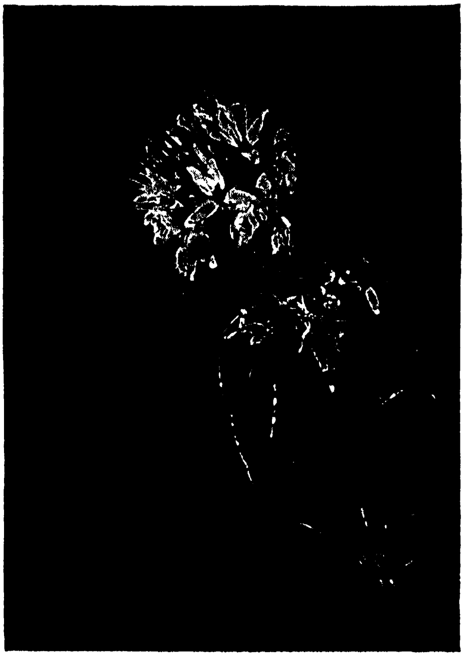
THE NEXT POETRY CHAPTER IS ON PAGE 6867.

FOUR INTERESTING FLOWERS

The Fragrant Evening Primrose with its broad flower and small rosette of narrow leaves.

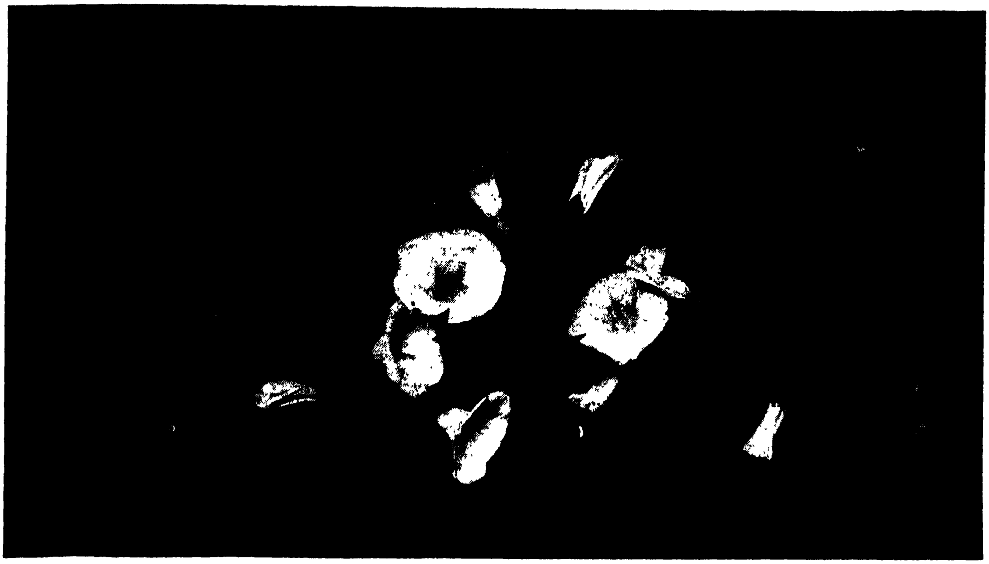


The broad flower, closely rolled buds and narrow leaves of the Bitter-root, Montana's state flower.



The spider-like flowers and drooping pods of the Rocky Mountain Bee Plant, which is sometimes called Skunkweed.

The flower clusters of the Sulphur Flower as they grow near the foot of the mountain on slender stems a foot high. Photos, W. J. Cribbs



Courtesy, Brooklyn Botanic Garden

The bell-like flowers of the convolvulus. The morning-glory belongs to this family.

FLOWERS OF NORTH AMERICA

THE FLOWERS OF THE MIDDLE WEST

PERHAPS the easiest way to make the acquaintance of some of the most conspicuous flowers of the Middle West is to group them according to the regions in which they usually grow. Taking the Rocky Mountains as the great backbone of this part of North America, we may distinguish five regions, or zones, at different altitudes, each having its own set of hundreds of flowers. In all, there are not less than five thousand different flowering plants in the five zones that are easily recognized. These divisions are:

The plains, rather dry, level and almost treeless, with short grass and a profusion of low flowers in the moist months of spring. Farther north this zone may be divided into three prairie steppes, all differing somewhat.

The foot-hills, with scattering trees of pine and oak and taller grasses and shrubs. Here the flowering plants are larger and the flowering season is longer.

The mountain zone, chiefly covered with forests of pine and spruce, with parks or open spaces occupied by meadows. Here the rainfall is good, the forests are dense, and the flower display is magnificent. Several of the national parks are mostly within this mountain zone.

The subalpine zone, including the higher mountain slopes, where the forest trees become shorter but the undergrowth remains luxuriant and the flowers are showy and abundant.

The alpine zone, above the forests, often with extensive alpine meadows well carpeted with flowering plants during its short spring and summer. Here all the plants are dwarfed, with short stems and small leaves, but with flowers that retain the full size of those of the lower zones. Many think that the colors are purer and more brilliant than those of the plains and the foot-hills.

In the vicinity of Rocky Mountain National Park, Colorado, the plains region is mostly below 4,000 feet in altitude. The foot-hills extend from 4,000 to 6,000 feet, at which elevation the montane, or mountain, zone begins. About 9,500 feet marks the upper limits of the subalpine zone, while the alpine includes the portions of the mountains above 10,500 feet.

I. FLOWERS OF THE PLAINS AND FOOT-HILLS

In these and lower regions the water supply is rather scanty, so that many plants have small leaves that are economical of the supply, or thick leaves that store it up for time of need. Other plants are low, or appear above the surface for a short time only. Of the thousands, the following are a few of the more beautiful or more abundant.

THE EVENING PRIMROSES, WITH THEIR BROAD FLOWERS

A tuft of evening primroses
O'er which the mind might hover till it dozes
But that it's ever startled by the leap
Of bud into ripe flowers.

Widely scattered over the plains, and often rather high up on the foot-hills, are several kinds of Evening Primroses *(Œnothera)*. One of the most common is three feet tall, with alternate leaves and large erect buds. About sunset these buds quickly open and display broad yellow flowers, each with four petals that are usually an inch long. A long slender calyx tube supports the corolla a couple of inches above the capsule in which the seeds will be matured.

The closely related White Evening Primrose is also a rather tall plant with pinnatifid leaves and flower buds that droop toward the flowers that are opening on the stem below. Here the four petals are white, becoming pink as they grow older and remaining open during the day. They are sure to attract attention, as the corolla is from two to three inches across.

Some of these splendid flowers are sweet-scented and beautifully shaded with rose, and are known as the Fragrant Primrose, or Rock Rose *(Pachylophus)*. Some of the flowers are more than three inches across, while one of the most widely spread varieties is a low plant where the flowers nestle in the centre of a large prostrate rosette of slender-toothed leaves.

THE EVENING STAR FLOWER, WHICH OPENS AT SUNDOWN

Another flower with the evening-blooming habit has been rather appropriately called the Evening Star Flower *(Mentzelia)*, in spite of its large size. Unlike the night-blooming cereus, the flowers of this plant may open two or three times on successive evenings. It is a stout, loosely branched, herbaceous plant a little over a foot high, with lance-shaped leaves from whose sides project a few large teeth, giving it a thistle-like appearance. Small hooked bristles scattered over the leaves give it the name Stickleaf. The large flowers open at sundown with from five to ten white or light yellow petals, having a spread of three inches and disclosing a hundred or more long slender stamens. Although it can establish little claim to the name, it is sometimes called Prairie Lily or Gunebo Lily, probably because of the form of the white flowers.

THE BUSH MORNING-GLORY, WITH ITS ENORMOUS ROOT SYSTEM

Scattered through the rather dry plains that front the Rocky Mountains from Texas to Montana is found a remarkable Bush Morning-glory *(Ipomœa)*. Its branching stems form a clustering bush two or three feet across about the top of an enormous root as thick as a man's leg, and often quite as long, sometimes weighing as much as twenty-five pounds. This root seems to store water that enables the plant to remain vigorous during the hot, dry summer. The leaves, too, differ from those of the common morning-glory, for they are four or five inches long and very slender, but the flowers are of the familiar funnel shape, often three inches long, delicately shaded with attractive purple and pink.

THE PRICKLY POPPY, WITH ITS DELICATE PETALS

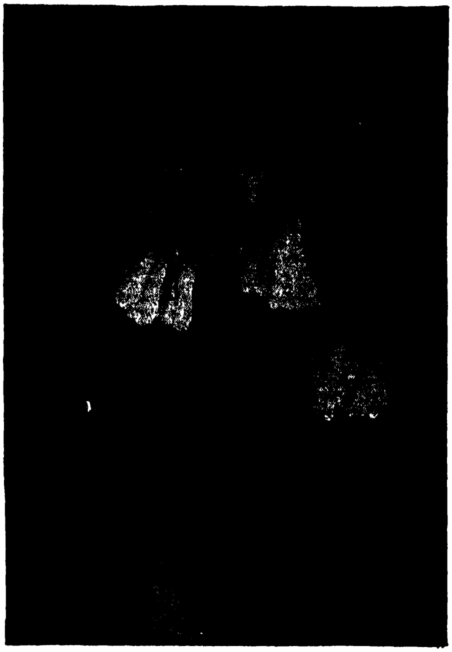
Large white flowers, two or three inches across, make the Prickly Poppy *(Argemone)* conspicuous. The five or six petals are as delicate as tissue-paper, and, like those of all poppies, endure for a short time only. The two or three sepals are adorned with projecting horns, and fall as the flower opens. The flowers are borne on a stout branching plant about two feet high, with prickly stem and bluish green leaves possessing a few rather strong prickles. When broken, the stem exudes a white, milky juice.

ROCKY MOUNTAIN BEE PLANT, SOMETIMES CALLED SKUNKWEED

A plant along the roadside, growing from two to four feet high, with round clusters of reddish purple flowers, so attracts insect visitors as to be known as the Rocky Mountain Bee Plant *(Cleome)*. Its long round pods show that it belongs to the Caper Family. The flowers have four petals, each a half inch long, and six stamens much longer than the petals. The trifoliate leaves are like those of a narrow-leaved clover, and the whole plant has a rather disagreeable odor that has given it the name Skunkweed, but does not detract from its attractive

FORGET-ME-NOTS, ASTERS AND EVENING STAR

The small blue flowers of the False Forget-me-not. The prickly fruit is seen below the flowers.



The drooping flowers of the Bluebell, or Drooping Forget-me-not.

The Daisy-asters with their narrow leaves and broad flowers, common in the Yellowstone National Park, where this photo was made.

The long white buds of the Evening Star Flower (Mentzelia) which after sundown open into great star-like flowers. Photos, W. J. Cribbs appearance nor lessen the number of bees that visit it for its nectar.

THE PRAIRIE, OR SAND, LILY, WHICH BLOSSOMS EARLY

The gleaming white flowers of the Sand Lily are among the very earliest to appear in the spring. They are scattered freely over the plains and foot-hills, some reaching into the montane zone. Slender green leaves spring from a short rootstock two or three inches below the surface, and as a loose rosette surround the cluster of six-rayed fragrant white star flowers that are just above the surface of the ground. The silver of the petals is in sharp contrast with the six golden stamens that cluster in the centre. The flowers are an inch across, but the slender perianth tube is over two inches long, reaching down into the ground, so that the ovary is more than an inch below the surface. As the seed ripens, the short stalk on which it is borne elongates and pushes the capsule near the surface, where it remains until thrust out of the ground by the leaves of the following spring.

THE PASQUE FLOWER, WHICH HAS A WIDE RANGE

Pasque means "Easter," for, since the Pasque Flower *(Pulsatilla)* is one of the earliest, it is often in bloom on Easter morning. Widely scattered from Montana, in the north, to Texas, in the south, it reaches eastward through the prairie and westward into the mountains, where it climbs to an elevation of 9,000 feet. The bud appears at the tip of a stem from three to six inches high. It is inclosed in a deeply cut and sharply pointed involucre of gray bracts of silvery hue and shining brightness. Soon the bud expands into a broad cup-like flower of lavender or bluish purple color, shading to white at the base. A central mass of yellow stamens provides a golden lining for the bottom of the cup. The six colored leaves of the flower are called sepals, since there is no green calyx to infold them. Each is over an inch long, and as they fade and fall, a rosette of finely divided leaves appears about the base of the stem that now carries a head of seeds, each adorned with a long curling plumose style. Among the many other names given to this plant Wild Crocus, Windflower and Prairie Smoke are most commonly heard. It is the state flower of South Dakota. It is one of the most striking of all the flowers of the region and always attracts the attention of the visitor from other sections.

THE BITTER-ROOT, WHICH CLINGS TO LIFE

The Bitter-root is a beautiful and interesting flower. Belonging to the Portulaca Family, it clings to life with a tenacity that exceeds even that of its near relative the garden purslane, or "pulsey." The thick fleshy roots have grown after having been kept in a dry room for several years. This tenacity of life has given it the second part of its scientific name, *Lewisia rediviva,* the first part being given in honor of Meriwether Lewis, of the Lewis and Clark Expedition across the continent in 1804. The thick roots are full of starch, and were formerly used for food by the Indians, who collected them in the spring, when the bitter bark is easily removed. When peeled and boiled, the roots then have little of the bitter taste. Growing on open dry hillsides from Montana, Utah and Arizona westward, it blooms in the spring, producing a white or rose-colored flower from one to two inches across, with six or eight delicate petals. The flowers rise but a few inches above the ground from the centre of a rosette of narrow thick leaves. The bitter-root is the state flower of Montana, where it abounds in the Bitter Root Mountains.

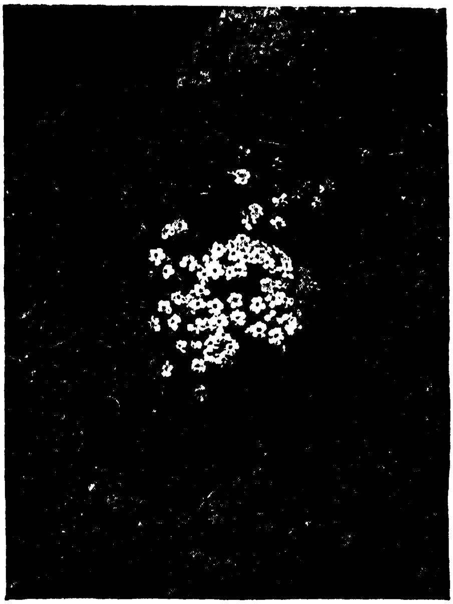
THE SULPHUR FLOWER, A RELATIVE OF THE COMMON BUCKWHEAT

Belonging to the Buckwheat Family, the Sulphur Flower *(Eriogonum),* is named for its yellow color. From a stout thick root short stems arise that bear rosettes of paddle-shaped powdery gray leaves. From among these, slender flower-stems stand from six to ten inches high, supporting an umbellate cluster of small simple sulphur-yellow flowers. On gravelly banks of the plains the plant spreads and ascends the mountains till it is far above the timber-line, decreasing in size as it climbs. On the mountain-top the flowers remain of the same size as those on the plain, and the root is very little smaller, but every other structure is reduced and dwarfed, an entire plant being less than two inches high.

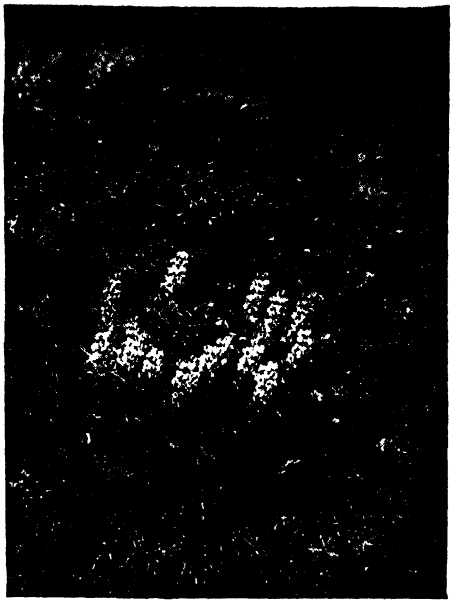
THE UMBRELLA PLANT, WHICH DIFFERS IN COLOR

The Umbrella Plant is almost exactly like the sulphur plant, except that the flowers are white or cream, tinged with pink. It, too, ranges from the plain to

GAY MOUNTAIN FLOWERS



The white Mountain Phlox like patches of snow upon the mountainside. This picture was taken in Yellowstone National Park.



A cluster of light blue Lupines on the mountains of the Yellowstone National Park.

Photos, J. W. Cribbs

An Alpine meadow carpeted with Mountain Daisies, each flower nearly an inch across. This field was seen in the Colorado Rocky Mountains at 11,000 feet.

Photo, George D. Fuller

the mountain-top, diminishing in size as it climbs higher and higher.

THE FIREWEED, WHICH IS ALSO CALLED WILLOW-HERB

Strange flower, thy purple, making haste
To glorify each blackened waste
Of fire-swept land,
Is with a blessed meaning fraught,
And we—when pain has fully wrought—
Shall understand.

The habit of coming in quickly after forest fires and covering the unsightly waste with handsome flowers has given its name to the Fireweed *(Epilobium)*. The long willowy leaves that screen the charred and blackened trunks with their luxuriance have also given it the name Willow-herb. It is a handsome, showy plant, from three to six feet tall, with stems and branches and petioles shading from white to rose and ending in crimson buds. The flowers are an inch across, with four broad petals, eight stamens, and a long four-lobed style. In color they are reddish lilac, some shading away to almost white. The corolla is at the top of a long ovary which, when mature, forms a slender capsule from two to three inches long, filled with small seeds well tufted with silky down. When ripe, the capsule splits into four long valves, releasing the feathery seeds that float on the breeze for long distances. This wide dispersal of its seeds assures the fireweed of being among the first plants to reach a burned-over area. Through July, August and September the plant blooms on, during the last month filling the air with its silky plumed seeds.

GAILLARDIA, SOMETIMES FOUND IN GARDENS

A close relative of the sunflower, the *Gaillardia* does not seem to have acquired a common name, and yet its splendid flower is to be seen throughout the prairies, the plains, and much of the montane region. Of the Composite Family, its flower-head has a compact disk surrounded by a radiating ring of strap-shaped flowers. The entire bloom is from two to four inches across, the colors usually shading from yellow at the tips of the rays to dark orange passing into purple at the centre. So handsome are the flowers that the *Gaillardia* has found its way into gardens and is cultivated for its beauty. The plants are a foot or two high, with most of the leaves basal, varying in form from lanceolate to deeply pinnatifid. The flowers are on long slender stems that make them easily picked and displayed in vases.

SUNFLOWERS, LARGE AND SMALL, TALL AND SHORT

Scattered over the western plains, Sunflowers *(Helianthus)* reach their climax display. Large and small, tall and short, they turn their yellow faces constantly to the source of light and life.

The Sunflower turns on her god when he sets
The same look which she turned when he rose.

The display of golden disks is not limited to the true sunflowers, but is shared by the Dwarf Sunflower *(Helianthella)* and the Balsam-root *(Balsamorrhiza)*. The latter has a thick root abounding in gum, while the leaves of both form a loose rosette about the leafless stem that bears the flowers.

THE CACTUS FLOWERS, WHICH HAVE INVADED THE NORTH

The Cacti are really most at home in the desert, and are most numerous in the arid parts of the Southwest, but two or three have ventured far to the north and are plentifully scattered over the plains even in Montana and Saskatchewan. They are curious plants in which the leaves are often completely absent and the leaf-work is done by the thick succulent stems. Perhaps the most abundant variety is the small Prickly Pear *(Opuntia)*, with broad flat stems developed in joints that are about an inch across and two or three inches long. These joints, when young, have a few needle-shaped leaves, but they soon drop off. Stout spines are scattered over the stems in great abundance—spines so sharp and strong that they easily pierce through a leather shoe. Water is stored in the stem so that the plant is able to flower in the hot, dry summer.

The flowers are cup-shaped, composed of many bright petals surrounding numerous long stamens. The most abundant prickly pear has bright yellow flowers two inches across, but red and purple varieties may also be found. The fruit is pear-shaped, fleshy and edible, some of the larger ones from Mexico finding their way into the fruit markets.

The prickly balls of the Pincushion, or Ball, Cactus are also found scattered in the short grass of the plains. At times single spiny balls rather larger than an egg are found, and again dozens are heaped together in a prickly mass. Here the flowers are composed of long lanceolate purple petals. New Mexico and Arizona have each selected a cactus as the state flower.

YUCCA FLOWERS, WHICH CAN ENDURE DROUGHT

In the same dry portions of the plains in which the cactus grows the Yucca forms a rosette of dagger-like leaves, and from the centre of the barricade sends up a great spike of creamy white flowers. The leaves are often more than a foot long, and the stem rises to a height of from two to six feet, with drooping bell-like flowers over an inch long. So sharp are the leaves that the name Spanish Bayonet is quite appropriately applied to the plant.

Six white perianth leaves form the drooping flower, while within are six stamens and a long style. The pollen, which is quite sticky, is carried from the stamens to the stigma at the tip of the long style by a small white insect known as the Pronuba moth. During the evening, when the Yucca flowers are most widely open, the moth gathers a ball of pollen from one flower and flies at once to another. Here she pierces the wall of the ovary and lays an egg. Then, going to the stigma, she forces the pollen-ball between its lobes and her work is completed.

The developing pollen fertilizes the ovules and they develop into seeds. At the same time the egg of the Pronuba hatches, and the tiny worm, or larva, begins to feed on the developing seeds. When full grown, the larva eats its way out of the pod that has now become upright, and drops to the earth. It usually happens that the larva has left untasted enough ripe seeds to pay for the food that it has eaten. Flowers not visited by the Pronuba remain unfertilized and produce no seeds, so the existence of the plant and of the insect depends upon the curious visits and labors of the Pronuba mother moth.

II. THE LUXURIANT FLOWERS OF THE MONTANE ZONE

In the Rocky Mountains the montane zone occupies the slopes of middle elevation and includes all the taller, richer forests. Pine, spruce and fir trees are most plentiful, and their shade is often so dense that only a few shade-loving flowers are able to grow in the deep woods. Many open spaces, however, are found along streams or in the flat-floored valleys where natural mountain parks are developed and where grass land and forest mingle. Here mountain meadows are found in which floral display reaches its climax. On account of the good water supply furnished by the more abundant rains, the plants are taller and are more closely massed than in the plains or the foot-hills. In these mountain parks, several of which are now preserved, are found natural flower gardens affording a display unsurpassed in any country in the world. Here indeed do

> A thousand odors rise,
> Breathed up from blossoms of a thousand dyes.

While the variety is too great, and the number too large, for us to describe them all, some of the most abundant and most beautiful must be mentioned.

MOUNTAIN DAISIES, WHICH CARPET THE MEADOWS

While the daisies of the lowlands sprinkle the meadows with silver and gold, those of the mountains add to the white and yellow colors shades of purple and blue that give even greater beauty to mountain meadows. Varying almost as much in size as in color, the Mountain Daisies *(Erigeron)* are from one to three inches across their heads, and from eight inches to two feet in height. They reach their best development in the open mountain parks at altitudes of between 6,000 and 9,000 feet, but do not stop there. On to the very top they go, and some of the alpine meadows are carpeted thickly with daisies that are only two or three inches high but with flowers an inch across. Other names for these flowers are Daisy Fleabane and Fleabane. One of them, the Black Woolly Fleabane, has the stem covered with purplish black hairs, and fifty or sixty white rays surround the yellow disk.

The daisies reach their climax in the Giant Daisy *(Wyethia)*, so abundant in the Yellowstone National Park and adjacent areas. It comes early in the summer with huge blossoms, four inches across, at the top of almost unbranched stems a foot and a half tall. The yellow disk is surrounded by broad white or cream-colored rays notched at the ends. Their size and habit of growth make Sunflower Daisy an appropriate name.

The Daisy-aster *(Townsendia)* is the smaller plant, with almost as large flowers, and is found on the drier hillsides. The leaves are small; and the stems are unbranched and seldom more than six inches high, but they support flowers three inches in diameter, with yellow disks surrounded by bright blue or purple rays.

MOUNTAIN ASTERS, WHICH BLOOM UNTIL FROST

The Mountain Asters are closely related to the daisies, differing from them chiefly by being produced on more branching plants, by being smaller in size, and by having more highly colored rays. They also come later in the season, beginning in late summer and continuing until frost comes. During the season

Everywhere the purple asters nod,
And bend, and wave, and flit.

THE MARIPOSA LILY, ONE OF THE SHOWY MOUNTAIN FLOWERS

The Mariposa Lily *(Calochortus)* is one of the showiest flowers of the mountains. It is found from Canada to Arizona, reaching its best development midway between, and extending its range far to the west. The broad cups, held erect on slender stems, are formed of three broad petals within three narrow green sepals. The plants vary in size but are usually over a foot high, and the flowers are often two inches across. In color, too, there is a wide range. One of the most plentiful and most beautiful has petals white or tinged with lilac and streaked with purple, a distinctly purple band appearing above the yellow base. Its scientific name is *Calochortus Gunnisonii,* the first word meaning "beautiful plant" and the latter being given in honor of Captain Gunnison, who discovered it surveying a route for the Pacific Railway in 1853.

A variety with yellow petals spotted with purple is known as the Sego Lily and is the state flower of Utah. Like its relatives, the Sego Lily is perennial from a bulb, and this bulb is used for food by the Utes and other Indian tribes of Utah.

THE WILD HELIOTROPE IN THE MOUNTAIN MEADOWS

In the moist mountain meadows, along with daisies, lilies and other large flowers, the small white blossoms of the Wild Heliotrope *(Valeriana)* add no small part to the beauty of the landscape. Here the white corollas are funnel-shaped and not more than one-eighth of an inch across, with three projecting stamens and five small pointed lobes often tinged with mauve or yellow. The display is accomplished by grouping the tiny sweet-scented flowers into flat-topped clusters a couple of inches across. The branches from below raise other clusters to surround the central one. The thick juicy stalks are from ten to twenty inches high, and bear large opposite glossy leaves, each with from three to seven lobes.

THE LARKSPUR, WHICH THE FARMER DREADS

The tall Larkspur *(Delphinium)* is one of the most stately flowers of the moist mountain meadows. The spike-like racemes reach a height of from three to five feet, with flowers that are usually "blue as the heavens they gaze at." Some varieties have white or purple flowers, and there are some not more than a foot high. All have the finely dissected palmate leaves so common in the Buttercup Family, to which the larkspurs belong. Both the sepals and petals are colored, and one of the former is extended backward into a long spur that gives its name to the flower. The scientific name *(Delphinium)* means "dolphin," and is given on account of the fancied resemblance of the flower to that creature.

Although so beautiful that many varieties are cultivated in gardens, the larkspur has a bad reputation among farmers and cowboys, for it is very poisonous to sheep and cattle. This property has given the plant such names as Stagger Weed, Poison Weed and Cow Poison.

THE MONKSHOOD, WITH ITS PECULIAR FLOWER

Growing alongside the larkspur, closely related and of similar habit, the blue flowers of the Monkshood *(Aconitum)* have, instead of a spur, a helmet-shaped cap developed from one of its blue sepals. Its resemblance to a monk's cowl gives the common name. Blue and pink varieties are often to be found, all on spikes reaching a height of from two to four feet.

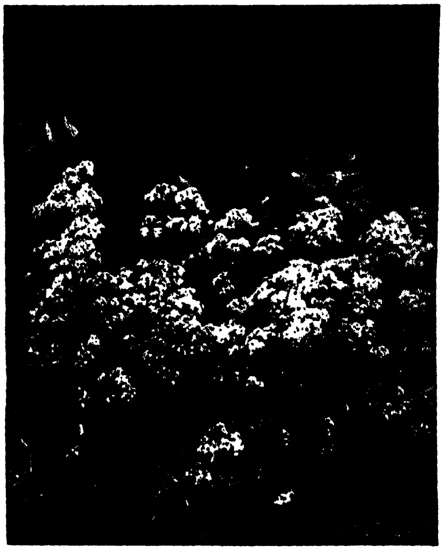
THE MONKEY FLOWERS, THE JESTERS OF THE MOUNTAINS

With their mocking faces the Monkey Flowers *(Mimulus)* are the floral jesters. Closely related to the garden snapdragon, the flowers have a similar structure. Each has a long green calyx tube from which comes a bright-colored tubular corolla that spreads open into two lips, the upper turned backward and the lower spreading into three lobes, forming a fanciful monkey's face.

Two kinds are likely to be found in

TALL AND SHORT FLOWER MEMBERS

A mountain meadow with mountain daisies and one flower of mariposa lily.



Photo, George D. Fuller

The northern bedstraw. Some species of this family were once used to stuff bed tickings.

The yucca belongs to the lily family. This species flourishes in poor soil, even in drifting sand. It is sometimes called silk-grass.

Photos, L. W. Brownell

The willow-herb, or fireweed, has pinkish purple flowers. It is called fireweed because it abounds in fields that have been burnt over.

damp spots. One named for the explorer Lewis *(Mimulus Lewisii)* is a foot or more high, freely branching with opposite lanceolate leaves covered with a viscid pubescence. Its flowers are rose-red or purplish, with tubes a full inch long and a laughing face that shoots out its ripe red lips at the passing traveler.

In similar or in more shaded places, on somewhat smaller plants, are the yellow blossoms of the Yellow Monkey Flower, which shows its kin to its larger relative by the dark red spots on its yellow throat. It grows shorter and shorter as the mountain is climbed, until near the top we may find but one inch-long flower on a plant two inches high.

All these monkey flowers have a peculiar sweet odor which is so strongly developed in one found in Colorado and Wyoming that it has the name Musk Plant and has made its way into gardens and greenhouses.

THE LUPINES, WHICH GROW HIGH ON THE SLOPES

Scattered over the mountain slopes where the open stand of trees allows the sunlight to reach the ground, the Lupines *(Lupinus)* form a showy carpet. The leaves are compound, five to ten narrow leaflets radiating from the tip of the petiole, and are often soft with downy hairs. The pea-shaped flowers, usually bright blue, but sometimes variegated or shaded to white, are thickly clustered into a spike.

Those on the lower parts of the mountains are a foot or more in height, with many branches and spikes, but as they ascend the slopes other shorter varieties come in, until near the tops of the peaks there may be but a single flower-spike in the midst of a low rosette of leaves. These alpine lupines are only two or three inches high, but often of the deepest blue color.

LOCO WEEDS, THE TERRORS OF THE STOCKMEN

In the mountain valleys and down to the plains are many spots covered with the silvery gray-green leaves and clustered flowers of the Loco Weeds. They belong to the Pea Family and all have pea-shaped flowers clustered in a spike, or head. The different varieties vary much in color from white to purple and blue. Their leaves are composed of many leaflets pinnately arranged on long petioles, most of the varieties being soft with silvery hair. Most of them are more properly called Milk Vetches *(Astragalus)* and are not only harmless, but useful in covering the plains and providing forage. A few are poisonous and really deserve the name of Loco, or Crazy, Weeds.

When horses, sheep or cattle eat these loco weeds they act in a crazy, drunken manner, and, what is even more peculiar, they develop an unnatural appetite for the plants, as does the opium-eater for his drug, and wish to eat nothing else. The result is sickness and death. The worst offender is the Purple Loco, or Woolly Loco *(Astragalus)*, a low plant with silky white leaves and purple flowers. It is found from Texas to Canada. The White Loco *(Aragallus)* is almost as widely distributed, and while its flowers are usually white on the plains, they become pink, violet and purple in the mountains. It may require an expert to tell the poisonous loco from the harmless, but all may enjoy the attractive flowers of both.

LITTLE RED ELEPHANT AND THE BETONYS

In the higher mountain bogs and in the marshy land along streams grows a slender plant with narrow fern-like leaves, whose dark red tubular flowers are strongly two-lipped. The upper lip ends in an upturned tube so long that it resembles an elephant's trunk. Fancy may also see in the flower a miniature of the flat forehead and flapping ears of the great animal as well as his curved trunk, and hence the name Little Red Elephant. The scientists, too, have seen the elephant's trunk, for they have called the plant *Elephantella grœnlandica*, the latter word indicating that it is also a flower of Greenland and the Far North.

With similar fern-like leaves the flowers of the Betonys *(Pedicularis)* are quite as two-lipped as those of the little red elephant, to which they are closely related. They lack the curved trunk, however, and are frequently known as the Louseworts. Yellow and white ones go up into the open woods of the subalpine regions, some of them forming fine large plants.

III. FLOWERS OF THE SUBALPINE AND ALPINE ZONES

The subalpine zone begins where the forests of the mountain are composed of trees that are decidedly lower in stature than those of the middle elevations. At first the forests, although low, are thick and dense, but they gradually become more open and interrupted by areas of scrub and grass land. The trees become deformed, bent and twisted by the wind, and at the upper edge of the zone upright trees cease entirely. Thus begins the alpine zone, which continues to the top, or until it encounters a cap of perpetual snow and ice. Spruce, fir and pine trees grow in the alpine zone, but with prostrate trunks and low matted branches. There are also stretches covered with shrubs, among which willows and heaths are abundant. Most extensive of all the alpine associations are the alpine meadows, in which dwarf plants of an infinite variety are rich with flowers of a hundred hues. These often take the form of mats, or cushions, with short stems, small leaves, rather large roots, but with flowers of large size and brilliant colors.

In the alpine zone spring, summer and autumn are compressed into the few warm weeks of midsummer. Very few spring plants are in bloom before June, and the autumn flowers are passing before the end of August. The same shortening of the season is found to lesser extent among the subalpine flowers.

THE COLUMBINES, WHICH HAVE A WIDE RANGE

The graceful columbine, all blushing red,
Bends to the earth her crown
Of honey-laden bells.

The Red Columbine *(Aquilegia)* is not confined to the mountains, but is scattered over hillsides far to the east and north. From a cluster of divided leaves it sends up light, airy stems a foot or two high, branching and bearing large drooping flowers and buds that open in succession. The flowers consist of five red sepals and five red petals. The former expand like petals, and the latter are extended backward into long hollow spurs terminating in knobs filled with honey. The flowers are usually scarlet, with the edges of the petals golden yellow. From the centre of the flower the numerous stamens and the five slender styles hang as a golden tassel. So handsome is this columbine that it finds a place in many gardens.

Even more beautiful is the Blue Columbine, which reaches its perfection in the subalpine parts of the Colorado mountains and has been most happily chosen as the state flower of Colorado. Larger than the red, its flowers are two inches across and of less drooping habit. The spurs are long and straight, but still rich in nectar. In color it ranges from deep blue to nearly white, the lighter shades being more plentiful as it finds sheltered nooks among the alpine rocks.

Nor does this exhaust the list of these showy flowers, for the mountain-climber will occasionally find a small blue one near the top of the peaks, and many large yellow ones grow on the slopes below.

THE FORGET-ME-NOTS, SOME ONLY AN INCH HIGH

Widely scattered through the mountains and fringing streams are found the tiny blue yellow-centred disks of the Forget-me-nots. The flowers are arranged in loose one-sided spikes and are equally attractive whether they belong to the false or true varieties. The False Forget-me-not *(Lappula)* has rather larger flowers. Its rotate corolla is a quarter of an inch across, and its fruit is made of four little nutlets armed with barbed prickles. These tiny burs also give the plant the name of Sticktights, but the beauty of the flowers should attract more attention than the prickles of the fruit.

The true Forget-me-not (*Myostis alpina)* has no burs, and the tiny flowers are quite fragrant. The plant is seldom more than six inches high. Many romantic legends are connected with these emblems of friendship and affection, a most charming one running:

When to the flowers so beautiful
  The Father gave a name,
There came a little blue-eyed one
  (All timidly it came),
And standing at the Father's feet,
  And gazing in his face,
It said, in low and trembling tones,
  Yet with a gentle grace:
"Dear Lord, the name Thou gavest me,
  Alas! I have forgot."
Kindly the Father looked him down
  And said: "Forget me not."

Another still smaller and even more beautiful forget-me-not *(Eritrichium)* may be found by those who climb to the top of the highest mountains. This dwarf beauty is scarcely an inch high; its little leaves are covered with soft white hairs; and its tiny flowers are of the clearest sky-blue. It is one of the rewards for mountain-climbing.

DROOPING FORGET-ME-NOT, OR BLUEBELL

Another beautiful blue flower belonging to the same Borage Family has the flowers with a tube-like corolla that makes the name Bluebell seem even more appropriate. Two or three species of this flower *(Mertensia)* droop over the mountain streams—the alpine form not more than six inches high—while lower down the slopes and species two or three feet high, very similar to their Eastern cousins known as lungworts, or Virginia cowslips. The buds are bright pink, but as they open they turn gradually to deep blue.

THE HAREBELL, FOUND IN POETRY AND SONG

This delicate flower, the true Bluebell of Scotland, sung by poets of every age, is found abundantly on the western mountains and on the eastern hills of America. An extremely hardy plant, the Harebell *(Campanula rotundifolia)* is found perched on precipitous rocks, anchored in the crevices of cliffs, or growing on the gravelly slopes of the alpine meadows, where its delicate bells swing and bend, but never break, before the sweeping winds.

Its name *rotundifolia* refers to the round basal leaves of the plant which wither early, while the narrow pointed stem leaves are present when the flowers appear. Near the foot of the mountain it is more than a foot tall, but in the alpine zone it is dwarfed to a fourth of that height. The erect buds droop on their slender stalks as they open into bells of the purest dark blue. The bell-shaped corolla, with its five lobes, retains its full size on the highest mountains, being always more than a half inch long.

PAINTED CUPS, ALSO FOUND IN THE EAST

Flowers that with one scarlet gleam
Cover a hundred leagues, and seem
To set the hills on fire.

No grander sight may be seen by travelers along the tree-line of the mountains than the wonderful slopes carpeted with the yellow, scarlet, crimson and purple masses of the Painted Cups. Red Indian Paint Brushes they are sometimes called, since the massive spikes resemble brushes dipped in red paint. The plant owes its brilliancy of color, not to the flowers themselves, but to the prolonged and red-tipped bracts, or reduced leaves, which stand one below each flower and almost hide it from view. Even the calyx is commonly more brilliantly red than the slender two-lipped corolla tube that often is merely a tint of greenish yellow tinged with red. It scarcely projects beyond the bracts, but bracts and flowers together form a dense spike. In height the plants vary from six inches to two feet, the best display being usually made by the shorter plants.

While it reaches its best development just below the alpine region of the mountains, the painted cup descends to the plains and goes far to the east, where the poet Bryant describes them as

Scarlet tufts
All glowing in the green like lakes of fire;
The wanderers of the prairie know them well,
And call the brilliant flower the painted cup.

PHLOX, ON THE DRY ROCKY SLOPES

On dry rocky slopes of the mountains snow-white patches appear in the late spring that on closer examination prove to be low mats of Phlox entirely covered with white flowers. The corolla is salver-formed, with a five-lobed border, and five stamens are within its tube, while at times the white is tongued with pink or purple. The leaves are needle-like, clustered about the stems so that they loosely overlap.

Although the Alpine Phlox descends to the plains and mingles with the short grass, it still retains its dwarf, matted, alpine habit. The Prairie Phlox, however, grows a foot tall, and brings its flat-topped clusters of reddish purple flowers high up among the grasses.

THE ARNICAS, THE SUNFLOWERS OF THE MOUNTAINS

During July and August the Arnicas are the most conspicuous yellow flowers of the higher mountain regions. They take the place held by the sunflowers on the plains, and it would not be far wrong to call them Alpine Sunflowers. Belonging to the Composite Family, both the disk and ray flowers are bright yellow, two or three inches across, and are supported on stems about a foot high. These stems are seldom branched, but carry three or four pairs of somewhat arrow-shaped leaves.

Several varieties are easily distinguished. The Heart-leaved Arnica grows abundantly in the rather open woods of the subalpine, while the more slender and graceful Alpine Arnica is nearer the top of the high peaks. In the latter there are from ten to twelve golden ray flowers about the yellow disk, each ray being double-notched at the apex. The seeds are furnished with a pappus of tufted bristly hairs that float them in the mountain breezes.

THE ALPINE PINK, COMMON ON MANY MOUNTAINS

> There, cleaving the ground, it lies
> With multitude of purple eyes
> Spangling a cushion green like moss.

Where the last line of vegetation grows, prostrate upon the earth, the Alpine Pink *(Silene acaulis)* displays its cushions. From a large tap-root slender branching stems form dense tufts from one to three inches high and from three to eighteen inches in diameter. Narrow linear leaves crowd the stems, forming a green cushion over which are thickly scattered starry flowers with five purplish pink petals. The flowers are solitary at the tops of the branches, and less than a half inch across, but are often so numerous that their petals almost touch one another. These flower-sprinkled cushions are often within a stone's throw of a snow-bank that lingers on the mountainsides.

No alpine flower is more widely spread, for it is freely scattered over the Rocky Mountains, is found on the summits of the White Mountains of New Hampshire, in Labrador and in Alaska, and also on the mountains of Europe and Asia. Some other names under which it is known are Moss Pink and Moss Campion.

WOOD NYMPHS, FOUND IN THREE CONTINENTS

The name is here a little misleading because the Wood Nymphs grow in the alpine regions high above the forests. The scientific name *Dryas octopetala* means "wood nymph with eight petals," and its creamy white flowers do usually have eight petals. The stems are prostrate and woody, with small thick oblong green leaves covered on the under-side with thick white hair. The flowers are like great creamy white buttercups, an inch across, held erect on stems two or three inches high. Numerous stamens and carpels occupy the centre of the flower, the latter ripening into seed-like fruits, with plumose styles an inch long attached. This fruit gives the name of White Mountain Avens by which many know it. In the Rocky Mountains from Colorado to British Columbia it goes north and from there east to Labrador and Greenland, whence it crosses the ocean to the Arctic and alpine regions of Europe and Asia.

NORTHERN BEDSTRAW, WHICH ALSO WANDERS FAR

Many flowers that are inconspicuous in the lowlands at once attract attention in the mountains since they are represented by more attractive species. This seems strikingly true in the case of the Northern Bedstraw *(Galium boreale)*, a plant often quite appropriately called Mountain Bedstraw. Belonging to the Madder Family, bedstraws are low plants with slender, often prickly stems on which narrow leaves are arranged in whorls of four (sometimes of six) and which bear small four-petaled white flowers. These flowers are so minute that they are usually inconspicuous, but in the northern bedstraw they are produced by the hundred on stems from eight to twelve inches high, forming a cloud of tiny white stars. The effect is not unlike frills of white lace over green silk, the leaves of the plant and its neighbors making the green background. The mountain-climber is sure to find the delicate flower along his trail even when he goes far afield. In Alaska and in Labrador the same white flower grows at low elevations, and it is also found in the mountains of Europe and Asia.

THE NEXT STORY OF PLANT LIFE IS ON PAGE 6927.

Photo, L. W. Brownell.

Over the plains grow hosts of Sunflowers, large and small, tall and short.

A beggar from Jidda entertains passers-by with a sword trick. The stones in the cans on his ankles rattle when he dances.

Pictures, Ewing Galloway

A street in Jidda, the seaport for Mecca-bound pilgrims.

Because Jidda is a town without a modern water system, vendors carry water for sale in goatskin bags like this.

ARABIA, IRAQ, PALESTINE *and* SYRIA

WHEN we think of Arabs we are likely to picture them as dashing riders on beautiful Arabian steeds, as men dressed in flowing robes and turbans, and armed with rifles, and with knives hidden in their broad sashes. This is, indeed, largely a true picture of the nomad or Bedouin Arabs, who roam the Arabian and Syrian deserts. But there are many other Arabs who live in cities or engage in agriculture. Arabs are found in many parts of Asia and Africa. But in southwestern Asia there is a group of states inhabited chiefly by Arabs, and we tell you about them here.

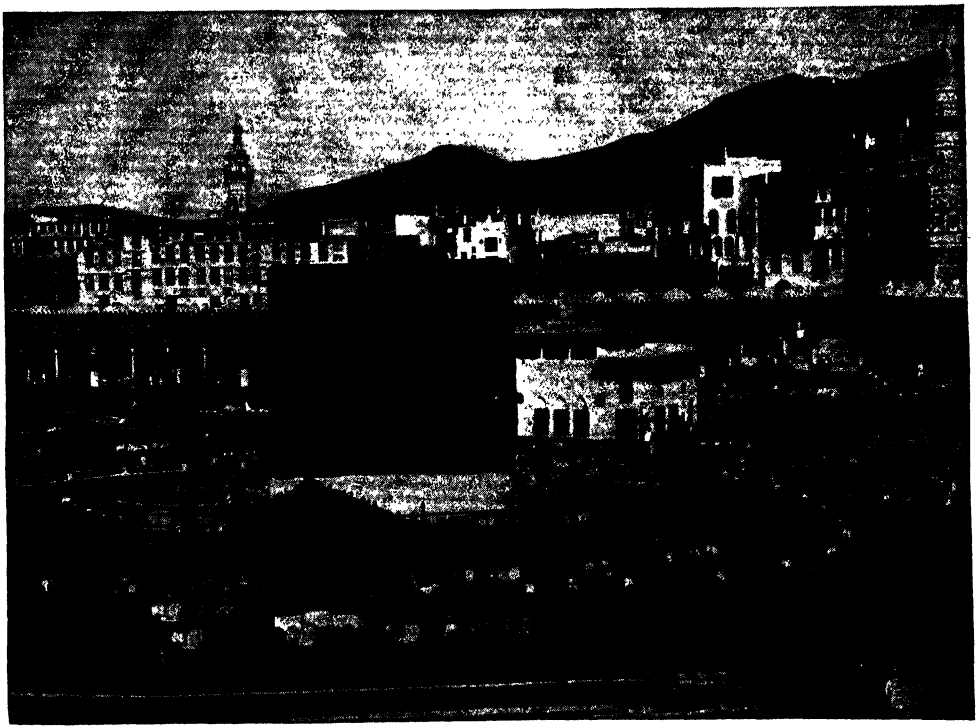
As you may imagine, the chief of these countries is Arabia itself. Arabia is a wide peninsula, extending toward the southeast, between the coast of Africa and the main continent of Asia. This peninsula is shaped like a large boot, with its toe pointed slightly northeast toward Iran (Persia) and India. It is bordered on the west by the Red Sea, on the south by the Gulf of Aden and the Arabian Sea, and on the east by the Persian Gulf and the Gulf of Oman. Most of Arabia is a desert. The inhabited regions are all on the rim of the desert and along the seacoast. The highest part of the country is in the west, beside the Red Sea, and from there it slopes down gradually toward the east, except for the mountains of Oman, at the toe of the boot. In the desert there are oases, places having water and vegetation and where people live. But oases are scattered and few, and they are inhabited mostly by Bedouin Arabs.

You will find on a modern map that a large part of this peninsula is called Saudi Arabia. The word Saudi comes from the name of a man, Ibn Saud, the strongest of recent Arabian leaders. Before 1926 he was sultan of Nejd, which lies mostly in the northern Arabian Desert. But after World War I he gained power over the important kingdom of Hejaz, along the northeastern coast of the Red Sea. To north and east and south he further extended his power, and then gave his own name, Saudi, to this new Arabian empire. A few states in Arabia remained independent of Ibn Saud, as we shall see, but they have little power of their own. King Ibn Saud left his country for the first time in February, 1945, when he traveled with some of his advisers on board an American destroyer to consult—near the Suez Canal—with President Roosevelt and with Prime Minister Churchill of Great Britain, who were then returning from the conference at Yalta.

Let us see something of Arabia's history, and then look at Arabia as it now exists. There is a legend among the Arabs that the first woman, Eve, lived in their country. However that may be, the Arabs began many centuries ago to spread into neighboring countries and to mingle with the earlier peoples there. Other nations held the power, however, and it was not until the seventh century A.D., with the influence of Mohammed, that the Arabs became a great world force.

We tell you elsewhere about Mohammed and Mohammedanism, as you may see in the Index. It should be mentioned here, however, what a great effect Mohammed had on his own people. He was a religious leader who united the Arabs in a single belief, and fired them with an enthusiasm to spread their religion far and wide. The bible of his teachings is called the Koran. Armed with that, and with the sword, the Arabs, after Mohammed's death, extended their rule over a great part of the then known world. Far beyond Persia to the east, and westward across northern Africa and up through Spain and almost into France the Arab tide rose. It was like a religious empire, but carried with it the sway of Arab political power and the spread of Arabian culture.

The Arabs had preserved much of ancient Greek philosophy, and they brought this into Europe in the early Middle Ages. Mathematics was another specialty of the Arabs. The numerals we ordinary use—1, 2, 3, 4,—are called Arabic numerals in contrast to Roman numerals—I, II, III, IV, and so on. The Arabs were also great farmers and traders, and they introduced into Europe such foods as spinach, asparagus, strawberries, lemons, dates, rice and sugar. They brought cotton as well. They had their own styles of art and architecture and literature: they have left traces of these in all the countries they have ruled. Arab power in Spain continued almost



Ewing Galloway

The famous Kaaba (black stone) in the great Mosque of Mecca, the sacred shrine of the Mohammedans.

until the time of Columbus, but in the east it was gradually taken over by the Turks. The Turks, however, had accepted the Arab religion. Thus Mohammedanism, or Islam, as its followers call it, swept far into eastern Europe with the later Turkish invasions.

LAWRENCE OF ARABIA HELPS THE REBELLION AGAINST THE TURKS

Turkish rule, like an iron hand, held sway in all the Near East until the first part of the twentieth century. But Turkey itself was growing weak, and in World War I Germany hoped to take over the real power in the territories that Turkey was holding. Thus it happened that the Allies encouraged these countries to rebel against the Turks, the allies of Germany. Lawrence of Arabia was a brilliant young Englishman who lived among the Arabs, so that they considered him almost as one of themselves. He did much to revive Arab national pride, encouraging the Arabs to throw off the centuries' old rule of the Turks. The state of Hejaz became a kingdom, with an Arabian king, Hussein. His son, Feisal, did much to help the British armies, not only in Arabia itself but also in clearing Palestine and Syria of the Turks. Feisal later became king of Iraq.

King Hussein of Hejaz soon proclaimed himself caliph, or religious leader, of all Islam. This angered another man in Arabia, who was the chief of a Mohammedan religious group called the Wahhabis. That man was Ibn Saud. He had already helped to drive the Turks from his sultanate of Nejd. Now he disputed the leadership in the Hejaz, and ended by adding that territory to his own domains, as we have seen. As a result of this and his other conquests, the new Arabian empire called Saudi Arabia has two capital cities. One is Riyadh, almost in the center of Arabia, and the other is Mecca, former capital of the Hejaz. The eldest son of Ibn Saud resides in Mecca as his father's viceroy, and is expected to succeed his father as king of Saudi Arabia.

The Hejaz is chiefly important because it includes the two holy cities of Islam. First and most important is Mecca, the birthplace of Mohammed (570-632 A.D.) and site of the shrine called the Kaaba, with its great black stone, which Mohammedans believe was given by the Archangel Gabriel to Abraham. The other holy city is Medina, where Mohammed is buried. In the year 622 A.D. Mohammed was driven from Mecca by his enemies. He fled to Medina. That event is called the Hegira, and from that date the Mohammedan calendar begins. Medina is now an important railway terminal Although Mecca is the western capital of Saudi Arabia, foreign diplomats sent as envoys to Ibn Saud do not live there. The holy city is reserved to Mohammedans, so these "unbelievers" reside in the near-by port of Jidda on the Red Sea.

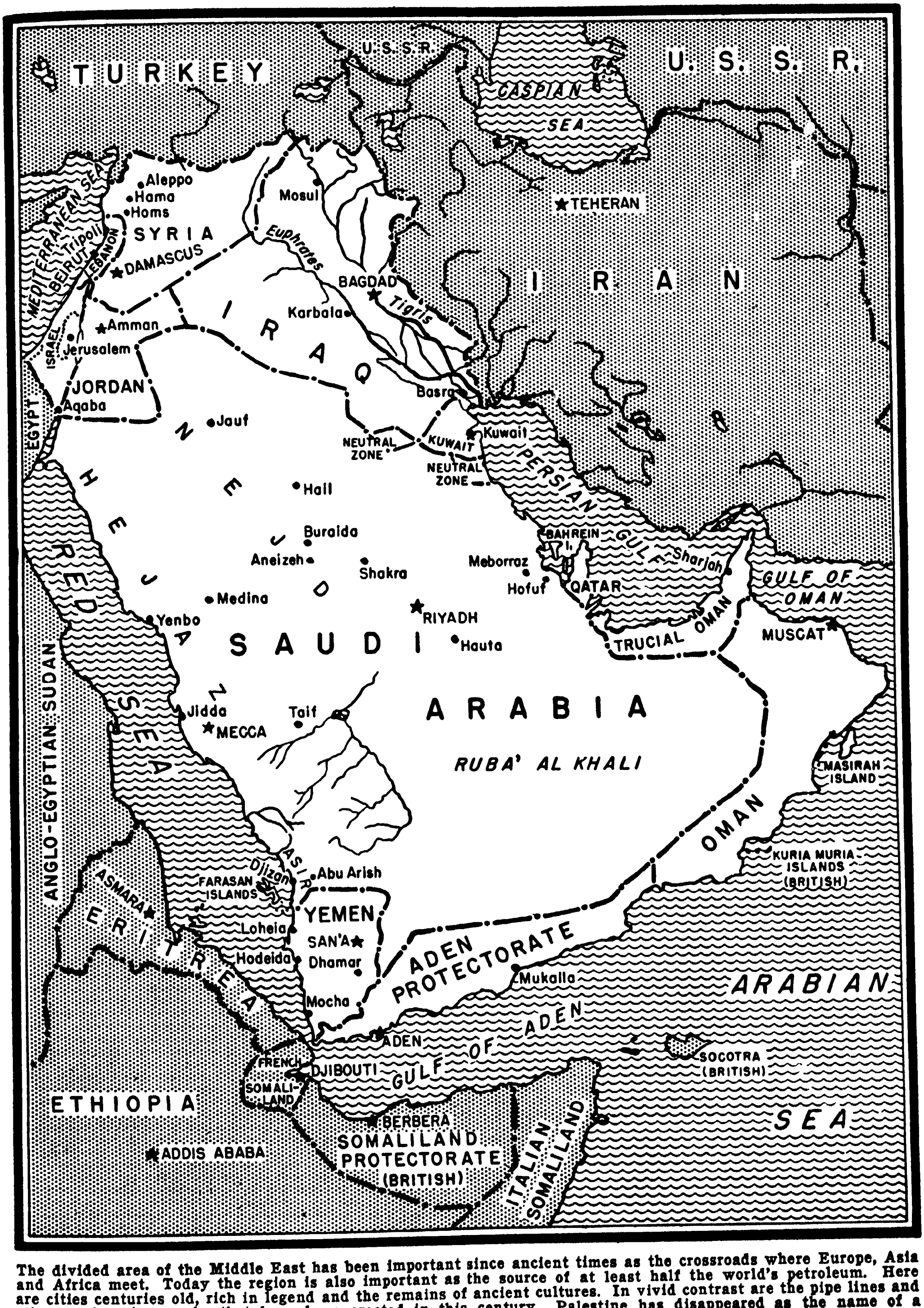
The chief independent states in the Arabian peninsula, outside of Saudi Arabia, are Yemen, in the southwest corner, and Oman, at the "toe," or southeastern extremity of the peninsula. Close to Yemen is the British colony of Aden. This includes the Protectorate—a large area of the southeastern desert land, and a region along the southern coast known as the Hadramaut. In Arabia's northeast corner is a small state called the Kuwait. On the Persian Gulf are also the Bahrein Islands, where pearl-fishing reaches a value of more than $5,000,000 a year, and where oil, also, has been discovered. Most of these eastern states of Arabia—the Kuwait, the Bahrein Islands and Oman, with its capital at Muscat—are ruled by native sultans or sheiks, but are under the general protection of the British Empire.

THE NEAR EAST COUNTRIES FORM THE ARAB LEAGUE TO SETTLE ALL DISPUTES

We have mentioned that Arabs live not only in Arabia but also form a large part of the population in near-by states. Since the end of World War II, these states have united to form an Arab League. In March, 1945, they sent representatives to Cairo in Egypt to sign the new constitution of the Arab League. This was an agreement which would govern the settling of all problems among the Arabs themselves, and all problems concerning Arabs and people of other nationalities. Members of the League are Egypt, Iraq, Lebanon, Saudi Arabia, Syria, the Hashemite Kingdom of Jordan, and Yemen. This represents an area of about 1,500,000 square miles and a total population of more than 33,000,000. The headquarters of the League are in Cairo. The League has already proved a strong force in the Middle East, though the various members have not always agreed among themselves. It was a power to be reckoned with when the Jews of Palestine were struggling to secure an independent state in their ancient homeland.

The Arabian peninsula has an area of 1,000,000 square miles and a population of about 10,000,000 people. This makes an average of only 10 people to a square mile. We must remember that much of Arabia's

SAUDI ARABIA AND HER NEIGHBORS



The divided area of the Middle East has been important since ancient times as the crossroads where Europe, Asia and Africa meet. Today the region is also important as the source of at least half the world's petroleum. Here are cities centuries old, rich in legend and the remains of ancient cultures. In vivid contrast are the pipe lines and other engineering works that have been erected in this century. Palestine has disappeared as the name of a country; in its place are the State of Israel and the Hashemite Kingdom of Jordan.

surface is desert, and that the people live chiefly in the lands beside the seacoast. Mecca is Arabia's largest city. It has a population of 80,000. We tell you about the peoples of the desert, the Bedouins, on page 6735. Arabs who have settled down to a life of agriculture or commerce are known as fellahin.

Farmers in Arabia raise many kinds of grain, vegetables and fruit, but the most popular food is dates. In Yemen a very fine grade of coffee is raised, and the port of Mocha has given its name to that product. From livestock Arabs gather the wool of the sheep and the hair of camels and goats to weave and make into tents, clothing, carpets and other things, while the hides of the animals are put to many uses. Metalworkers produce fine objects such as handsome daggers, beautiful ornaments of gold and silver, and bowls or coffee pots of copper and brass. Among Arabia's most important exports are oil, minerals and pearls. Since foreigners are active in the production of these things, modern European and American conveniences are becoming more familiar to the Arabs. Automobiles, radios and moving pictures are all popular, but they can not be used in any great quantities since much of the country is still backward.

Arabs of the desert are wild and vigorous, while farm and city Arabs live more quietly. But all have the strong spirit of their stock. Lawrence of Arabia once wrote "Arabs could be swung on an idea as on a cord." Mohammed used the idea of religious unity and conquest to swing his countrymen high into world power. Lawrence himself used Arabian independence from the Turks as an idea to win their help in World War I. Ibn Saud preached a strong, united Arab people. He has worked to modernize his country, against the tendency of the Arabs to live as they like and as they have always done. Oil has been found and is being produced in large quantities in Saudi Arabia near the Bahrein Islands. Perhaps a new era of prosperity awaits the Arabian people.

THE KINGDOM OF IRAQ

IRAQ has somewhat the form of a dog's head. Its chin rests along much of the northern border of Arabia, and its nose touches the top of the Persian Gulf. The state of Iraq came into existence after World War I. Its name is the Arab name for that region. Let us see something of modern Iraq and then look back at the great events in history which have taken place on this same spot.

Freed from the Turks by British armies in World War I, Iraq became an Arab kingdom under a British mandate. That is, the League of Nations appointed Britain to supervise the government in that country. Feisal, the soldierly son of King Hussein of the Hejaz was chosen as king of Iraq. When he died in 1933, his son, Ghazi, succeeded him. But this second ruler of Iraq was killed in an automobile accident in 1939. Then King Ghazi's four-year-old son became king, with the name of Feisal II, and his uncle, Emir Abdul Ilah, has ruled for him as regent. In May, 1945, the regent, now Prince Abdul Ilah, came to America, at President Truman's invitation, to consult on matters concerning his country.

Why is Iraq an important country? Partly because it is on the crossroads between Europe, Asia and Africa. But even more important, Iraq is one of the great oil-producing countries of the world. Oil has been called "liquid gold," so important is it in modern times. For this reason, the Germans, in World War II, under Field Marshal Rommel, drove across northern Africa, hoping to seize this great source of fuel and cut off its supply to the British fleet in the Mediterranean. By conquering Iraq, the Germans could also have stopped the Lend-Lease supplies for Russia, which the Americans were shipping up through the Persian Gulf. Iraq was saved at the great battle of El Alamein, in October, 1942, by British forces, with American aid.

The oil of Iraq has two chief outlets on the Mediterranean: one is at Tripoli in Syria, and the other at Jaffa in Palestine. The pipe lines run mostly through desert country, and the protection of these was a task of the greatest importance during the war. Perhaps the best-known oil center in Iraq is near Mosul in the north, where the oil is piped almost directly west to Tripoli.

Iraq has an area of 140,000 square miles, and a population of 3,560,456, most of whom are Arabs. East of Iraq is Iran (Persia); to the north is Turkey (the area called Asia Minor); on the west are Syria and Trans-Jordan. To the south are Saudi Arabia and the little Arabian sultanate of Kuwait.

Few rivers in the world are more famous

than the two great lazy streams of Iraq, the Tigris and the Euphrates, which flow to the southeast and empty into the Persian Gulf. Before reaching it, they join as one river with the modern name of Shatt al Arab. Seventy miles from the mouth of this river is the city of Basra, which the British have built up as the chief modern port of Iraq.

A gufa (native boat) on the Euphrates River.

Iraq is no longer under British rule. It became an independent kingdom in 1932. It is a hereditary monarchy, that is, the king is succeeded by his son or nearest relative. Iraq also has a constitution and a legislature with two houses, as in Great Britain and the United States. Iraq has kept friendly relations with Britian, and in 1943 joined in World War II against Germany, Italy and Japan. The capital of Iraq is Bagdad (or Baghdad), of which we shall have much to say later.

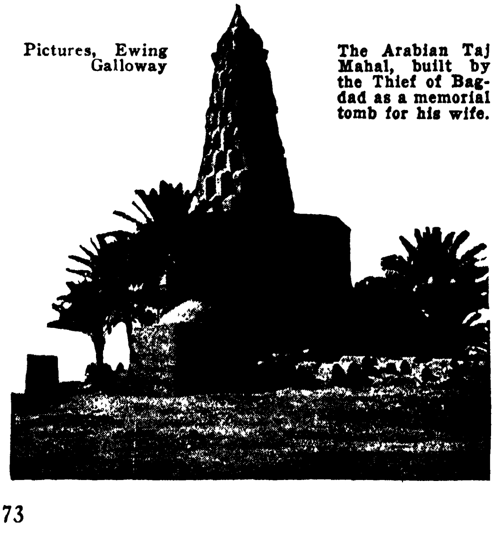
In addition to oil, the fertile soil of Iraq is well suited to agriculture wherever irrigation has been developed from the Tigris and Euphrates rivers. Grains and tobacco are raised, and there has been much experimenting with cotton. Large flocks of sheep are raised in northern areas. In spite of these developments, however, Iraq is largely a desert country, especially in the west, where the great "Stony Plain" forms a part of the Syrian Desert.

Germany, under Kaiser Wilhelm II, allied itself with Turkey and planned a great "Berlin to Bagdad" railway which would cut through the Near East and lead toward India. In both world wars the Germans drove toward Iraq, and in both they were defeated. The railroad was not built.

Let us look back now at some of the great events that have taken place in the country that is Iraq today. In ancient times this region was known as Mesopotamia, a Greek word meaning "the land between the rivers." Tradition has considered this as the site of the original Garden of Eden and thus the birthplace of the human race, according to the Bible story. The first traces of ancient civilization that were found in the region were those of a very early people called the Sumerians. Later on, these became mixed with other stocks, and a new kingdom arose, named Babylonia from its capital, Babylon. Babylon was south of modern Bagdad and closer to the Euphrates River, as we know from its ruins there today.

About the year 2100 B.C. there ruled a great king of Babylonia. His name was Hammurabi, and he was one of the first great lawmakers in history. The people of this region used to write by marking the letters into soft clay. They would then bake the clay as hard as stone, and thus very many of their writings have remained to this day. Modern scholars learned to read this writing by finding inscriptions which were written in several different languages. Some of these other languages were already known to the scholars, and thus they learned to read the Babylonian language.

The Babylonians built up a true civilization, cultivating the land and irrigating it with water from the rivers. But a warlike people, the Assyrians, swept down on their country and ruled it with great harshness. They attacked the neighboring kingdom of the Hebrews in northern Palestine, the Kingdom of Israel, and carried the people off as



Pictures, Ewing Galloway

The Arabian Taj Mahal, built by the Thief of Bagdad as a memorial tomb for his wife.

captives. They destroyed Babylon and built a new capital, called Nineveh, far north, on the upper course of the Tigris River.

But governments which rule by force do not always last long. The Assyrians were finally driven out and a new Babylonia arose, with a new city of Babylon more splendid than before. A powerful king, Nebuchadnezzar, built a magnificent palace there, and constructed the famous Hanging Gardens of Babylon, which became known to the Greeks as one of the Seven Wonders of the World. It is said that these were a series of terrace gardens on a hillside near the Euphrates River, built—in that flat country—for the King's wife, who loved mountain scenery.

Nebuchadnezzar was a cruel man. He punished a revolt of the Hebrews by destroying the city of Jerusalem and carrying the people away as captives. This Babylonian Captivity is recalled by the Jews in the beautiful Hebrew psalm "By the waters of Babylon, there we sat down and wept," and in many of the books of the Old Testament in the Bible. But the Babylonians, in their turn, were finally conquered by the Medes and Persians, who allowed the Hebrews to return to their homes: Later came the Greeks under Alexander the Great, and after that the Roman Empire held sway here, only to give place again to the Persians.

Then came the second great era of the country when the Arabs captured this territory in the sixth century A.D., during the Mohammedan invasions. Here the caliph, the spiritual leader of Islam and also its political ruler, established his capital at Bagdad. The city of today is a colorless town. Under the caliphs it became the largest and most beautiful capital in the world. Great palaces and magnificent mosques, superb buildings of every sort, riches and art and learning all centered here. Bagdad became known as the "Glorious City." The famous Caliph Harun-al-Rashid ruled there, near the year 800 A.D., when Charlemagne was the central figure in Europe and the two rulers exchanged gifts. Envoys of the Caliph were received even as far away as China.

Both Harun-al-Rashid and his wonderful city are known to us in the romantic stories of THE ARABIAN NIGHTS. This group of tales was originally called THE THOUSAND NIGHTS AND A NIGHT. The story-teller, Queen Scheherazade, was said to have entertained the king with a story a night to keep him from putting her to death. The legend has a happy ending. The Arabs kept adding to the stories, including new ones about their beloved Bagdad and the Caliph Harun-al-Rashid, who loved to hear these tales, and enjoyed having himself woven into them. Two of the most famous stories, ALADDIN AND THE WONDERFUL LAMP and ALI BABA AND THE FORTY THIEVES, are retold in your BOOK OF KNOWLEDGE. The plots of the tales were gathered from all countries and retold by the Arabs. THE ARABIAN NIGHTS has given us a glowing picture of the wonders of ancient Bagdad.

Ewing Galloway.
Bagdad melons for the family.

Gradually the Arabian empire was taken over by the Turks. Other invasions from the East destroyed the splendor which had risen there, and the country sank into ruins and misery. Until 1917 the Turks still held sway, and then the new Arabian kingdom of Iraq arose. Iraq is important now for its oil and for its position in the Near East. The Arabs are moving toward a new unity and strength. But it is doubtful whether any era can develop to rival the ancient splendors of Babylon and Bagdad.

THE STATE OF ISRAEL

THE independent state of Israel forms part of the historic region that men still call Palestine, even though it has been divided up among several nations. Palestine has always played a vital part in the history of mankind because of its position at the crossroads of Asia, Europe and Africa. It is important, too, because of its religious background. Christians think of it as the Holy Land where Christ was born and where He was crucified. For the Jews it is the Promised Land to which Moses led his people when they fled from bondage in Egypt. The Palestinian city of Jerusalem is dear to Mohammedans; within its walls is the rock upon which Mohammed is said to have prayed.

At the time when it was divided up, in 1948, Palestine had an area of 10,429 square miles and a population of 1,912,00. It was bounded by Lebanon on the north, by Syria and Trans-Jordan on the east and by the Mediterranean on the west. The Egyptian-Palestinian boundary extended from the Mediterranean southeastward to the extreme southern tip of Palestine.

The most fertile part of the region enclosed within these boundaries is the coastal plain. Farther inland, in the center and the north, the country is hilly. In the south there is a big desert known as the Negeb. The principal river is the Jordan, which flows southward through the Sea of Galilee to the Dead Sea. (See Index, under Dead Sea.)

THE ISRAELITES' STRUGGLE FOR FREEDOM IN BIBLICAL TIMES

Israelite tribes first settled in Palestine about 2000 B.C. They gradually extended their rule over it and finally set up a kingdom under Saul. This flourished for a time; then, in the tenth century, it broke up into two smaller kingdoms—Israel in the north and Judah in the south. In the centuries that followed the Jews tried desperately to maintain their independence. During much of this time, however, they were under the domination of one or another of the great empires of antiquity—Egypt, Assyria, Babylon, Persia and Rome.

In the seventh century A.D. the Arabs, who had accepted the teachings of Mohammed, overran the Holy Land. From that time, except for comparatively short periods, Palestine was under the rule of a succession of peoples of the Mohammedan faith. The last of these, the Ottoman Turks, took over the Holy Land in the sixteenth century and held it until late in World War I. By now Palestine was largely Arab in population; Jews and Christians formed small minority groups. The Holy Land had become, for the most part, a dreary waste; swamps and deserts had replaced the fertile lands of ancient times.

World War I broke out in 1914. Three years later the British invaded Palestine and captured most of it. British troops occupied the whole land after the end of the war.

In November 1917, Lord Balfour, the British foreign secretary, had announced that "His Majesty's Government view with favor the establishment in Palestine of a national home for the Jewish people." He had promised that Britain would do all it could to bring this about. The Balfour Declaration, as it was called, was endorsed by the victorious Allies. In 1920 the League of Nations gave Britain a mandate over Palestine in order to carry out the policy announced in the declaration.

AFTER CENTURIES, THE JEWS RETURN TO PALESTINE AS COLONISTS

The British set up a civil government in Palestine with Sir Herbert Samuel, a Jewish statesman, as the first high commissioner. The Jews now set to work earnestly to build up a Jewish homeland. They had begun that task some forty years before. Under the inspiration of a colonizing movement known as Zionism, they had set up a number of colonies for Jewish immigrants in the Holy Land.

After the British took over the Palestine mandate, the number of Jewish immigrants increased greatly. Some of the newcomers enrolled in the existing colonies or founded new ones. They irrigated the deserts, drained the swamps and built roads. Other immigrants settled in the towns. Outside the ancient city of Jerusalem, new quarters grew up with modern buildings of hewn stone and concrete. Tel Aviv, founded before World War I on the bare sand dunes north of Jaffa, became a flourishing city.

The Jewish community in Palestine increased by leaps and bounds. Some of the Arabs became alarmed; they feared that the Jews would become a majority group in Palestine. Arab hostility in Palestine caused several serious outbreaks. The worst of these came in 1936 when the Arabs killed and wounded a number of Jews.

After order was restored, the British sent a commission under Sir Robert Peel to investigate the situation. The Peel Commission recommended that the country should be divided up into two independent states, Jewish and Arab. The plan pleased neither the Jews nor the Arabs, and in 1939 the British abandoned it. They now announced that they would give up their mandate over Palestine in 1949. In the meantime they would limit Jewish immigration to a maximum of 75,000 for the period from 1939 to 1944. The Jews protested bitterly.

The year 1939 marked the outbreak of World War II. The Palestinian Jews realized that Great Britain was fighting a war to the death against Adolf Hitler, the arch enemy of the Jewish people. Hence they contributed both men and supplies to the Allied cause.

The end of World War II brought renewed trouble to the Holy Land. Large numbers of European Jews were now homeless because of the war. The Jews of Palestine were determined to bring into the country as many of these "displaced persons" as possible. Defying British restrictions, boatload after boatload of immigrants landed secretly. At the same time Jewish underground groups attacked the British, whom they denounced as invaders. At last, in April 1947, Britain turned the Palestine problem over to the United Nations (UN). In November of that year the UN General Assembly voted in favor of dividing up the country between the Jews and Arabs. The Jews consented to the proposal, but the Arabs did not.

On May 15, 1948, the British formally gave up their mandate over Palestine and a provisional Jewish government proclaimed the new republic of Israel. From the very outset Israel had to fight for its existence. The day before it came into being, the Arab countries of Egypt, Iraq, Lebanon, Syria and Trans-Jordan had declared war on Israel on the ground that the Israelis (inhabitants of Israel) were "rebels." The Arab allies took over the areas that the United Nations General Assembly had allotted to the Palestinian Arabs. They invaded some of the districts held by the Israelis. But under the inspired leadership of Haganah, the people's army, the Israelis more than held their own.

At last an American, Ralph J. Bunche, acting UN mediator for Israel, succeeded in bringing peace to the Holy Land. In 1949 Israel signed armistices with one foe after another. The Israelis now controlled most of Palestine. They were in an overwhelming majority in the sections they occupied, since many Arabs had fled during the fighting.

The year 1949 was memorable in the history of Israel for other reasons. In January the first national election was held; Israel's voters elected the members of the Knesset, or National Assembly. In the following month the Knesset chose as the first president of the Republic Dr. Chaim Weizmann, a famous scientist and Zionist leader. On May 11 Israel was admitted to the United Nations.

Israel occupies a total area of something like 7,500 square miles. It possesses all the coast of Palestine except for a strip from Gaza to the Egyptian frontier. Egypt holds this strip of land. Jordan occupies the central part of Palestine. As for Jerusalem, the older part of the city is in the hands of Jordan, while the Israelis hold the quarters outside the walls.

The Jewish population of Israel is estimated at 980,000 and the Arab population at 170,000. Hakiryah, or Sarona, a suburb of Tel Aviv, is the provisional capital. Tel Aviv, with a population of over 300,000, is the world's largest all-Jewish city. It is the manufacturing, commercial and financial center of the country. Haifa and Jaffa, on the Mediterranean, are the chief ports. The future of Jerusalem is still undecided. The Israelis claim the Jewish sections as their own.

Israel has a wide range of industries—glass and metal works, food and drug supplies, textile and leather factories, electrical and machine shops. Agriculture flourishes; oranges, wheat, barley, olives, melons, watermelons, tomatoes, grapes, figs and bananas are grown. The valley of the Jordan and the shores of the Red Sea yield rock salt and phosphates. Chemical plants extract potash, bromine and other chemicals from water drawn from the Red Sea.

THE HASHEMITE KINGDOM OF JORDAN

Israel's neighbor to the east, which used to be called Trans-Jordan and now is known officially as the Hashemite Kingdom of Jordan, was once an Arab state within the Palestine mandate. In 1921 it became a British protectorate, with Abdullah Ibn Hussein as emir, or ruler. The British recognized Trans-Jordan as a sovereign, independent state in 1946, and Abdullah took the title of king.

The area of Jordan, not including the territory held in central Palestine, is 34,750 square miles. There are about 340,000 inhabitants; of these about 300,000 are Arab Mohammedans and 30,000 are Arab Christians. The capital of Jordan is Amman (population, 100,000); other cities include Irbid, Mafraq and Aqaba. Aqaba, on the Red Sea, is the country's only seaport.

The eastern part of the country is made up largely of desert; but to the west the land is more fertile. Wheat, corn, barley, sesame, grapes, cotton, rice, sugar and tobacco are cultivated. The people possess large numbers of goats, sheep, cattle and donkeys. Minerals include phosphates, ochre, gypsum. Jordan has textile, leather and tobacco factories.

In recent years a plan to develope the agriculture and industry of Palestine has found a great deal of support. The plan was drawn up by Walter Clay Lowdermilk, a famous American agricultural expert. This is how it would work. A Jordan Valley Authority, modeled after America's Tennessee Valley Authority (TVA), would build a series of dams and reservoirs on the upper Jordan River to store excess water. This would be used for irrigating the land on both sides of the Jordan.

The Jordan Valley Authority would also connect the Mediterranean and the Dead Sea by means of a tunnel and a canal. The Dead Sea lies more than 1,200 feet below the level of the Mediterranean Sea. As the waters of the Mediterranean flowed swiftly to empty into the Dead Sea, they would turn the turbines of power houses set up along the way, providing abundant electric power.

Experts say that such a project might well bring about an era of prosperity and peace, perhaps throughout the Middle East.

SYRIA AND LEBANON

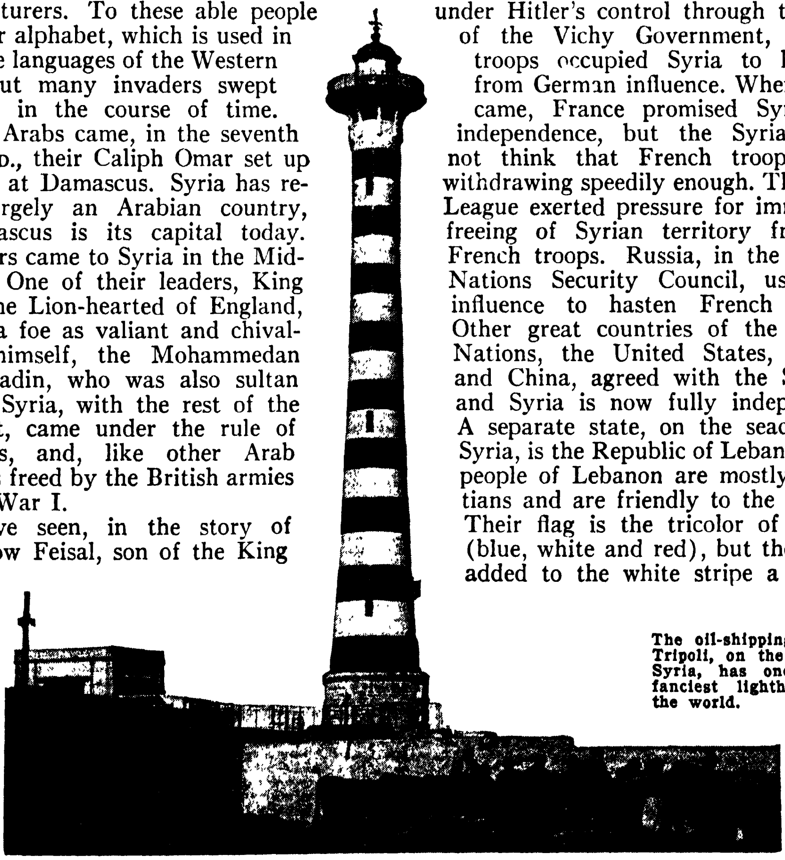
SYRIA is shaped like a triangle. On one side, to the north, lies Turkey. Another side, facing mostly to the southeast, borders on Palestine and Iraq. The third face of Syria looks westward, across the Mediterranean.

In ancient days the Phoenicians lived here beside the sea, and their ships sailed forth to distant ports, carrying traders and adventurers. To these able people we owe our alphabet, which is used in most of the languages of the Western World. But many invaders swept into Syria in the course of time. When the Arabs came, in the seventh century A.D., their Caliph Omar set up his capital at Damascus. Syria has remained largely an Arabian country, and Damascus is its capital today.

Crusaders came to Syria in the Middle Ages. One of their leaders, King Richard the Lion-hearted of England, met here a foe as valiant and chivalrous as himself, the Mohammedan leader Saladin, who was also sultan of Syria. Syria, with the rest of the Near East, came under the rule of the Turks, and, like other Arab states, was freed by the British armies in World War I.

We have seen, in the story of Arabia, how Feisal, son of the King of the Hejaz, aided in the liberation of Syria. He hoped to rule there as king. Events, however, resulted in his becoming king of Iraq instead, and all Syria came under the rule of a French mandate. There was a strong movement for complete Syrian independence, which finally became successful.

During World War II, when France came under Hitler's control through the rule of the Vichy Government, British troops occupied Syria to keep it from German influence. When peace came, France promised Syria her independence, but the Syrians did not think that French troops were withdrawing speedily enough. The Arab League exerted pressure for immediate freeing of Syrian territory from all French troops. Russia, in the United Nations Security Council, used her influence to hasten French action. Other great countries of the United Nations, the United States, Britain and China, agreed with the Syrians, and Syria is now fully independent. A separate state, on the seacoast of Syria, is the Republic of Lebanon. The people of Lebanon are mostly Christians and are friendly to the French. Their flag is the tricolor of France (blue, white and red), but they have added to the white stripe a picture



The oil-shipping port of Tripoli, on the coast of Syria, has one of the fanciest lighthouses in the world.

Ewing Galloway

of one of the famous cedar trees of Lebanon, which are mentioned in the Bible. The capital of Lebanon is Beirut, or Beyrouth, the chief seaport of the whole Syrian territory. Situated there is the American University, and also a French Catholic university. The oil-shipping port of Tripoli is also in the territory of Lebanon. For tourists there is the ancient city of Baalbeck to be visited. The great ruins of temples and other buildings there, which were built by the Romans, are among the most amazing sights in the world. Some of the blocks of stone used in their construction are each as big as a full-sized modern house. There also are to be seen castles and forts built by the Crusaders.

The northern part of Syria's coast is the district known as Latakia. Here is raised and exported a special brand of tobacco, called Latakia. It is used for blending with other tobaccos. Syria's chief river is the Euphrates, which comes down from Turkey, flows south and east, and continues on into Iraq. In the southernmost corner of Syria is the region of Jebel Druze. Here dwells the wild desert tribe, the Druses, who caused much trouble for the French rulers of Syria.

Cities of Syria include Aleppo, Palmyra—where once ruled the valiant Queen Zenobia—and the capital, Damascus. The city of Damascus is called the Pearl of the Desert, so beautiful and fertile is the plain which surrounds it. Its fruits grow in rich abundance; there is a saying "You can sup or breakfast in Damascus for nothing." The city is thoroughly Oriental, with its bazaars, its Great Khan—a sort of enormous inn and trading center—and its many fine mosques. In this city were once made the famous Damascus blades for swords and daggers, so strong they could slash through heavy iron, so sharp they could cut the most delicate gossamer fabric floating in the air. Here, too, was produced that rich cloth called damask, whose name is shortened from the city's name. Damascus, since the dawn of history, has been a trade and travel center for the peoples of the Near East. To Christians it is famous as the city where St. Paul was converted. Its chief thoroughfare today is that "street which is called Straight," where the Apostle stayed. To Moslems Damascus is a holy place, for here is buried Fatima, the daughter and only child of Mohammed.

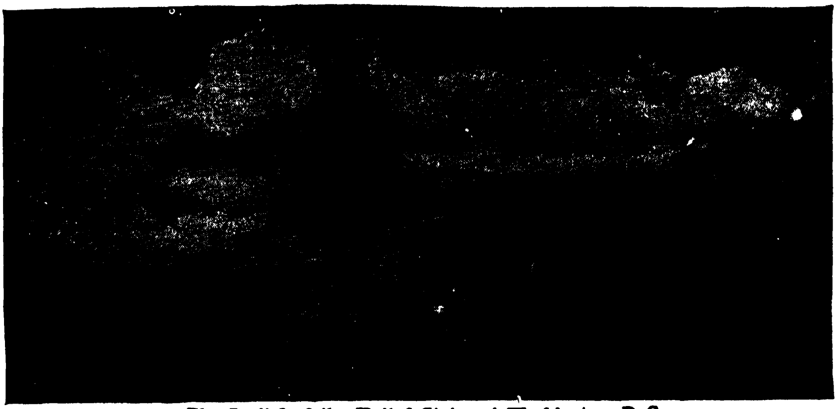
Syria is, therefore, a land rich in history and ancient traditions. As an Arabian state it faces the prospect of new importance today, with the awakening of a spirit of progress among these peoples of the Near East.

THE NEXT STORY OF ALL COUNTRIES IS ON PAGE 6735.

These Syrian women, from the desert, are loading a camel with heavy bags of goods bought in the village of Baalbeck.

Pictures, Ewing Galloway

Here is a street scene in the city of Damascus, the capital of Syria. Lining the sidewalks are shops where people come to trade while the children play on the sidewalk.



The Capitol of the United States at Washington, D. C.

ARCHITECTURE IN THE UNITED STATES

THE architecture of the United States begins with such importations from parent lands as were made by the first pioneers. From Mexico came the very simplified Spanish Renaissance of the Franciscan missionaries, working their way north through what are now New Mexico and Arizona to California; from Louisiana came a certain French quality which never extended beyond the boundaries of the state. Pennsylvania contributed a vaguely German quality, New York its memories of the Netherlands, while Massachusetts and Virginia brought in and perpetuated the English tradition of the seventeenth and eighteenth centuries. Only the last two influences achieved any degree of permanency or continuity, and these maintained themselves for a space of almost exactly two hundred years. After the lapse of three-quarters of another century the architecture of all these early periods was rediscovered, and the influence of the Spanish missions, the farmhouses of Pennsylvania, and the so-called "Georgian" work of New England and Virginia has played a large part in the building-up of good architecture after the degradation of seventy-five years that followed the extinction of the old traditions about the year 1825.

Much of the architecture of Mexico under the early Spanish domination was of a magnificence comparable with that of Spain itself, and to it was added a naïveté and a certain barbaric opulence contributed by the native workmen that gave it a place by itself. In the missions of the Southwest the magnificence was gone, but the spontaneousness remained, and the result was a group of simple and direct religious structures full of charm, and excellent models for the new work that was to come later on. The same value lay in the German and Dutch beginnings, and these have recently been used to the best effect in the notable Philadelphia school of domestic architecture which has produced such fine results during the first quarter of the present century. The "Colonial" tradition of Virginia and New England has been even more persistent and pervasive and has perhaps extended more widely than any other. In every case the prevailing influence has been toward that simplicity and directness which characterized all the work of the first two centuries of what now constitutes the United States.

The first settlers in English colonies brought with them little knowledge or craft of architecture, but they had a clear memory, while the real affection for beauty and fitness which had accompanied man throughout history, was still their heritage, and was not to be wholly extinguished for a period of nearly two centuries. At the time of their emigration the native Gothic had quite passed away and the new Renaissance imported from Italy had become thoroughly domesticated, so what they did here was of that mode, though fundamentally modified by new and local conditions. At the very start the persistent Tudor tradition had a certain effect, and many-gabled houses of irregular design, with big outside chimneys, gables of curvilinear form, Jacobean details, leaded and latticed windows and genuine half-timber construction were not uncommon. Nearly all of these have disappeared or been utterly transformed, so we do not realize how prevalent they were, but "Bacon's Castle" in Virginia and the "House of the Seven Gables" in Massachusetts give an idea of what was probably universal in houses of the larger sort prior to the year 1700.

ENGLISH METHODS SKILLFULLY ADAPTED IN EARLY BUILDING

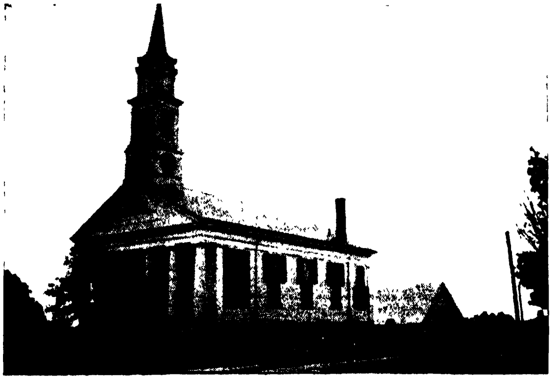
During the first seventy-five years of the colonies money was scarce and building materials other than wood were unavailable; what brick there was came from England and Holland. The architecture was therefore a wooden architecture, and very cleverly and with fine instinct did the housewrights of the time adapt their English methods to the new circumstances. Later, when there was more wealth and bricks were either imported in greater quantities or made on the spot, the fully developed domestic Classic of Queen Anne was taken over, and there was a century of fine building when a truly local style of great distinction was developed along the entire seaboard of the thirteen original states. Housewrights became master builders, shipwrights turned into joiners and woodcarvers, while the necessity for economy and the lack of highly trained craftsmen enforced a certain simplicity and restraint that were most beneficial to good art. The houses of this period are all of extreme reserve and elegance, free of the pedantic quality that the professional architects of England were smiting into their work, always beautifully proportioned in whole and in part, and, with their sparing detail, of a refinement and distinction that even the Adam brothers might have envied.

EARLY EXAMPLES OF PUBLIC BUILDINGS AND CHURCHES

Public buildings were few and simple, and nearly all have been destroyed, the Old State House in Boston, Independence Hall in Philadelphia and the City Hall in New York City standing as fine examples. As for religious structures, the heavy hand of Puritanism in New England made impossible anything but an extremely ugly type of barn-like conventicle with no architectural value whatever, and it was not until a little later, when the Church of England was sufficiently tolerated to permit the building of its own structures, that some effort was made, as in Christ Church, Boston, to add something of beauty and variety to the Puritan norm, and along the lines of what Wren was doing in England. Outside the Puritan pale there was less reason for ugliness, and from New York south to Savannah there was an attempt at real beauty and at the preservation of some sense of historical continuity. Pennsylvania, Delaware, Virginia, South Carolina, all contributed charming and sometimes even noble churches, at first with curious hints of a sort of wistful Gothic memory, later with full acceptance of the mode fixed in England by Inigo Jones, Christopher Wren and Nicholas Hawksmoor.

From about the middle of the eighteenth century for a space of seventy-five years some really magnificent churches were built, at least in comparison with what had gone before, and among these must be counted Kings Chapel, Boston; St. Michael's, Charleston; Christ Church, Philadelphia. Most of these were designed on their general lines by amateurs, but in Boston the first professional architect had made his appearance in the person of Charles Bulfinch, and New England can still claim the honor of possessing much of his work. The housewright who had become so proficient as decorator and craftsman during the last century was even then at the height of his competency, McIntyre, of Salem, being a distinguished figure among many able men, and the architect of the time did little more than plan a general scheme, leaving to carpenter, mason and joiner the application of all technical and ornamental detail and the responsibility for determining and carrying out the construction. Bulfinch was an educated gentleman and a conscientious citizen. He used his craftsmen generously and gave them wide opportunities through the magnitude of the work he undertook, while co-ordinating it in structures of great variety and scholarly and academic in form after the English fashion of the day.

By the time Andrew Jackson was elected to the presidency and a new political and social world had come into being, the varied strands of American building that reached back through two centuries had been knit together into a fine and very individual style, strictly American and quite cleverly differentiated from the architecture of seventeenth-century England, from which it had derived its first energy and inspiration. With the completion of the rebuilding of the Capitol in Washington—joint work of Thornton, Latrobe and Bulfinch—this period may be considered to have come to an end. Hitherto, however simple or primitive, nothing really bad had been produced; after this date, and for a period of more than half a century, there was little that was not bad, and that little was the result of the swift dying-away of the old inherent instinct for propriety and beauty, while the bad that held the stage was the worst that history has ever recorded.



A "Græco-Baptist" church.

The fine old Athenæum in Boston was one of those hold-overs from a better day, and numerous churches, North and South; but by the time of the War between the States the final catastrophe had been accomplished, and from then on to 1880 there was nothing to record that possessed any element of honor except some efforts to acclimatize the Victorian Gothic then in vogue in England.

The stately and pretentious "Roman mode," begun perhaps at the University of Virginia, and in which Thomas Jefferson played a large part, had dissolved into absurd box-like structures, both ecclesiastical and domestic, where amusing porticoes, carefully worked up from books on the Greek and Roman Orders, but made of neatly fitted strips of thin wood and painted white, were applied in the most arbitrary fashion to their utilitarian supporters, with their ill-proportioned windows and doors badly spaced in clapboarded walls broken only by the omnipresent green blinds—certainly the most "banderlog" type of building ever devised by man. Then came the eclecticism of the eminent Mr. Downing's villas and cottages "in the Italian mode," or the English, the Swiss or the French—pathetic distortions in flimsy materials of the good work of an earlier day, and then at last, what was even more horrific, the "Carpenters' Gothic" of the Forties in all its crass stupidity and positively vicious ugliness. Upjohn struggled vainly to stem the tide of barbarism, and in Trinity Church, New York, produced something that, in spite of its falsities of construction and its many imitations and the complete lack of scale in its details, really had something of the appearance and quality of an English parish church of the fourteenth century. Following after came Renwick, Congdon, Haight, the younger Upjohn, all able and conscientious men, and though success in larger churches such as St. Patrick's Cathedral and Grace Church in New York was not very marked, many really beautiful and rather original churches of smaller size were produced, carefully studied from English originals but intelligently adapted to local conditions.

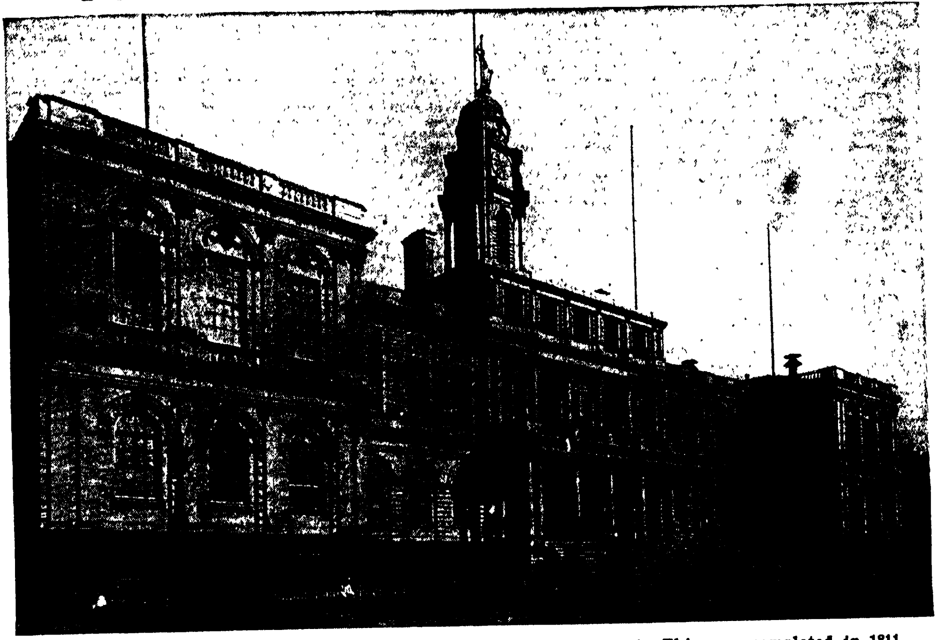
Simultaneously the influence of John Ruskin was beginning to have its effect, and a sort of "Gothic" never yet seen on sea or land put in its appearance. Never did any men work harder or more devotedly than the protagonists of this style. They were bound to get beauty, originality and truth, if they had to get it with an ax. Polished marbles and granite, stone- and wood-carvings of amazing ingenuity and elaboration were sedulously worked up from examples offered by the animal and vegetable kingdoms; every strange-colored stone and variety of slate was sought with avidity and combined in wild and wonderful patterns. Nothing was left alone; everything was elaborated to the last degree, and the result was something rich and strange. Ware, Van Brunt, Cummings in Boston, perhaps Furness in Philadelphia, were leaders, and whether history justifies their work or not, they deserve deep respect for their sincerity and their meticulous and unremitting work.

So matters stood about the time of the Centennial in Philadelphia, when for the first time Americans began to be conscious of the fact (then to them revealed) that all was not for the æsthetic best in the best of all possible nations. It was something of a shock when the output of the ten years following Lee's surrender was suddenly brought forward for estimation. There had been, and was, a perfect riot of depraved and expensive viciousness in what was dubbed "jig-saw-and-batten" work, or for some unearthly reason was called "Queen Anne." As for the "French roof" style, no one knows where it came from or why; there was nothing French about it, and nowhere could one trace any resemblance to any known style or genre. It was the Topsy of architecture and even more unregenerate. And in the midst of this "witches' Sabbath" of futility and confusion something happened, and the name it bore was H. H. Richardson.

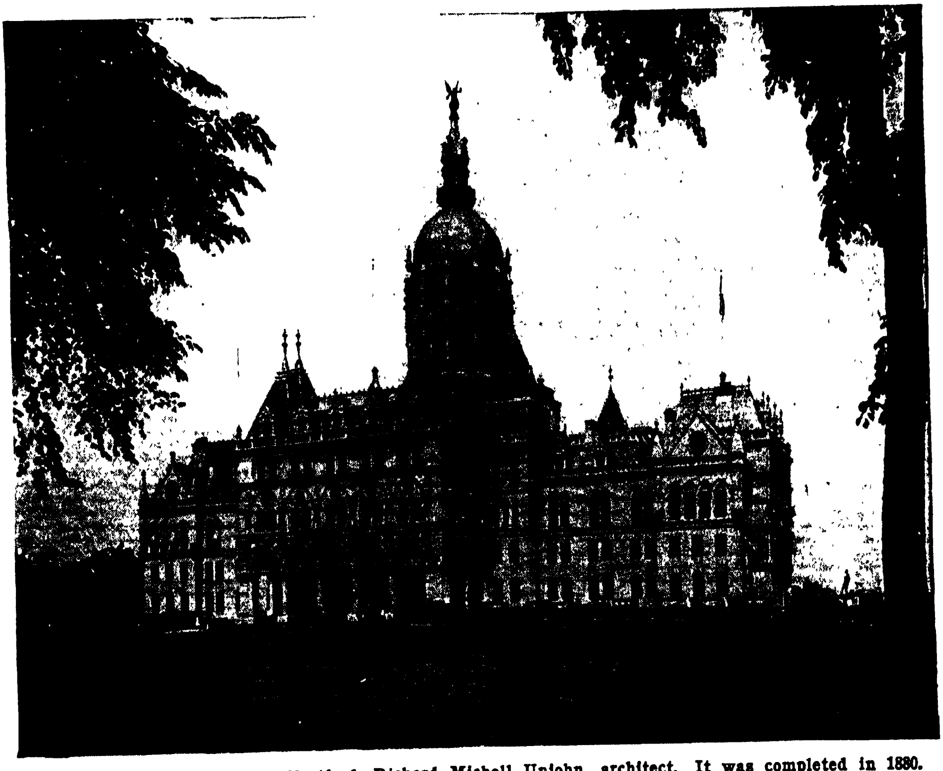
A house of the Victorian period.

The eclecticism of the mid-century had had its sumptuous fruition in the châteaux of Fifth Avenue and the palaces of Newport, with Hunt, Post and Herter as the competent exponents thereof, and there could be nothing beyond along this line. Richardson dawned like a dynamic force, and a new but evanescent era dawned. Out of southern France and northern Spain he brought back to America what he had found there—a powerful, vital, semibarbarous, or at least half-developed art, and by his own stupendous vitality galvanized it into a semblance of reality. He was no copyist: what he took he transformed, and from Trinity Church, Boston, onward, for a few pregnant years he imposed on America his powerful and stimulating creations—titanic, original, and with a frankness, freshness and freedom that were like a fresh sea-wind dispersing miasma. He died at the height of his power, but as long as he lived there was only one possible style, "Richardson Romanesque," and every practitioner turned to it and tried to use it whether he could or not—and mostly he could not. The ponderous majesty of Trinity and the Pittsburgh Court House and the Albany City Hall was applied to fire-engine houses, primary schools, Baptist and Methodist conventicles and frame cottages with complete artistic abandon, and for a meagre interval America had indeed a "national style." Then the giant passed and the pigmies succeeded to his glory, for it was the tragedy of his case that only these remained. The King was dead but no one could be hailed with the cry, "Long live the King!" A very few of the coming men in the East produced creditable simulacra, then they gave up and reverted to more academic modes; while the wave of the "Romanesque decadence" rolled resistlessly west, submerging the plains and the mountains and the coast in its detritus of a lost cause, and finally vanished in the setting sun,

PUBLIC BUILDINGS OF TWO PERIODS



The white marble City Hall, in New York, John McComb, architect. This was completed in 1811.



The Connecticut capitol at Hartford, Richard Michell Upjohn, architect. It was completed in 1880.

leaving in its wake a wide æsthetic desolation.

ARCHITECTURAL THOUGHT AWAKENED BY H. H. RICHARDSON

History will record H. H. Richardson as the greatest architectural force America has known, for one thing he had accomplished, and that was the awakening of the country from its architectural lethargy. There could now be no going-back: society was ready for a new impetus, and this arrived about 1890 in vigorous but extremely varied guise. There were no less than five lines of influence, each more or less directed by strong personalities. McKim, Mead and White had come forward as the protagonists of a fine and scholarly and exquisite Italianism, and from the day of the Boston Public Library this was almost the preponderating force. Good taste had returned after a banishment of seventy-five years. Carrère and Hastings took much the same field, but on it they imposed a most ingratiating romanticism and captivating poetry. The St. Augustine hotels were an inspiration to the whole profession. In Chicago that great genius Louis Sullivan, in some sense inheriting from Richardson, began developing a mystical philosophy of architecture and a strange new type of real beauty to express it—an art that was purely personal and "caviar to the general." Wilson Eyre in Philadelphia took domestic architecture as his field, with charm and picturesqueness as his guiding star, and became in a sense the pathbreaker for the very wonderful Philadelphia school that came almost immediately into being. In Boston, Cram, Goodhue and Ferguson gathered up the shattered remnants of the Gothic approximation, linked themselves with the young English expatriate Henry Vaughn, declared the Gothic style not dead but sleeping, and started in to take up the story of English Perpendicular Gothic, undo the work of Renaissance and Reformation, and go on from where the break occurred. Finally, and at many hands—Arthur Little, of Boston, being perhaps the most prominent—there was a recrudescence of the Colonial or Georgian idea, and once more architects began to get back to the inherent quality of the old eighteenth-century work, instead of mocking it, as they had just been doing, by silly travesties of its misapplied details.

THREE MAIN FORCES: CLASSICAL, GOTHIC, AMERICAN DOMESTIC

It was a sufficiently varied list of impulses, but all were vital and vigorous and all working to the good. Little by little some of them drew together and coalesced, until there were three main forces: the Classical, whether Italian, English or Modern French, which took to itself everything except churches, colleges and minor domestic architecture; the Gothic, which very shortly controlled practically all church-building together, in its transitional Tudor form, with a large proportion of university, college and school work; and what might be called the American Domestic style, which started from many bases, Colonial, "Mission," Tudor, Pennsylvania farmhouse, but generally worked itself out in terms of propriety, personality and most distinguished beauty.

These powerful educative influences now began to operate through the American Institute of Architects as a coordinating and directing force, through the schools of architecture which had appeared in so many places after the dynamic beginnings under Professor Ware, and through the excellent architectural magazines. At last architecture had taken its place as an exalted profession; there was a fine frenzy of emulation and a real spirit of unity and co-ordination. Architecture in America had attained its majority.

As the Philadelphia Fair had been a revelation of incapacity, so the Chicago Fair was a revelation of potentiality and a demonstration of beauty. Here for the first time all the great architects of Classical sympathies came together to work toward one end, and they produced a vision of Imperial Rome so beautiful and so stimulating that it had an indelible influence on society. With Burnham, of Chicago, as the chief inspiring and coordinating force, a dream of loveliness was created on the edges of ugliness, and after this there really could be no going-back.

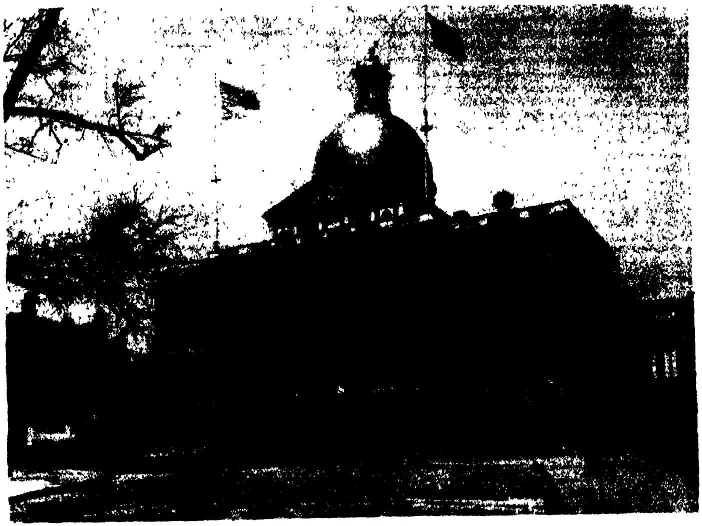
Nor was there any such retrogression. It may be said that from then on there has been a steady advance along every line, until to-day America stands foremost among the nations in architecture and its allied arts—and all this the product of fifty years. It is a record hardly to be matched in history, except perhaps

BUILDINGS IN THE UNITED STATES

ST. PHILIP'S CHURCH, CHARLESTON, S. C. J HYDE, ARCHITECT

CHRIST CHURCH (OLD NORTH), BOSTON, MASS., WILLIAM PRICE, ARCHITECT

FIRST CHURCH, BENNINGTON, VERMONT ASHER BENJAMIN, ARCHITECT



STATE HOUSE, BOSTON, MASS., CHARLES BULFINCH, ARCHITECT

PARSON CAPEN HOUSE, TOPSFIELD, MASS.

"WESTOVER," CHARLES CITY COUNTY, VA.

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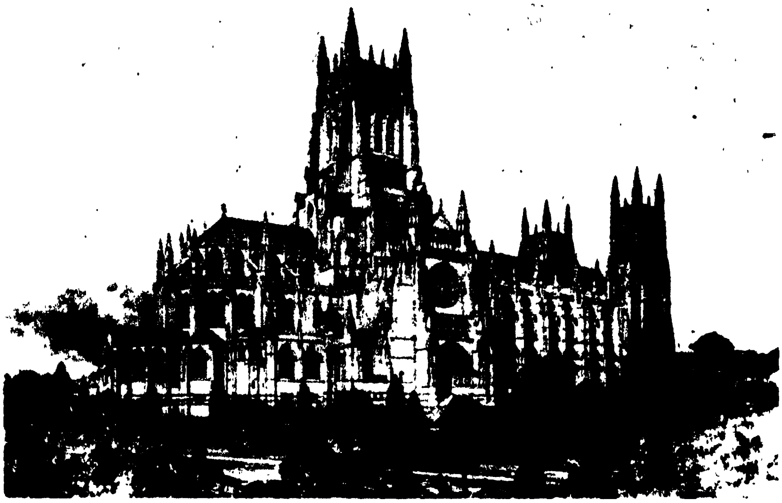
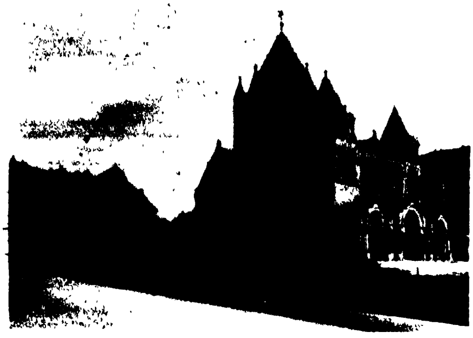
ST. PATRICK'S CATHEDRAL,
NEW YORK CITY,
RENWICK, ARCHITECT

CHURCH OF ST. VINCENT FERRER,
NEW YORK CITY. BERTRAM
GROSVENOR GOODHUE, ARCHITECT

ST. THOMAS CHURCH, NEW YORK
CITY. CRAM, GOODHUE AND
FERGUSON, ARCHITECTS



CATHEDRAL OF ST. JOHN THE DIVINE NEW YORK CITY, CRAM AND FERGUSON, ARCHITECTS



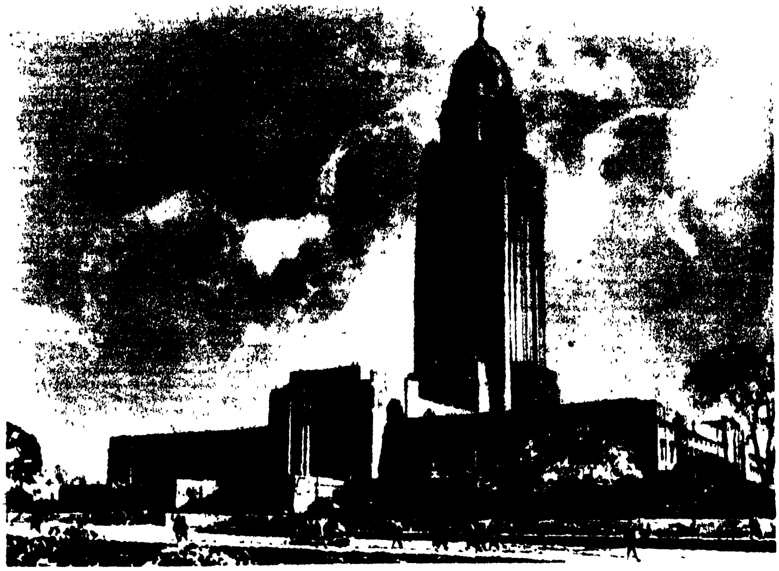
TRINITY CHURCH, BOSTON, MASS.
H. H. RICHARDSON, ARCHITECT

CARMELITE CONVENT, SANTA CLARA, CAL.
MAGINNIS AND WALSH, ARCHITECTS

PROCTER HALL, PRINCETON UNIVERSITY, CRAM, GOODHUE AND FERGUSON, ARCHITECTS

HARKNESS QUADRANGLE, YALE UNIVERSITY, JAMES GAMBLE ROGERS, ARCHITECT

SCOTTISH RITE TEMPLE, WASHINGTON, D. C. JOHN RUSSELL POPE, ARCHITECT



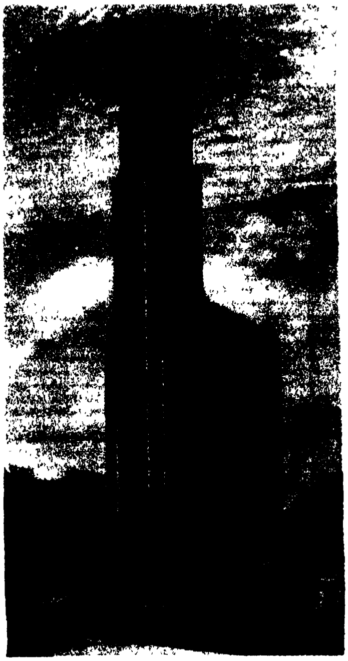
NEBRASKA STATE CAPITOL, LINCOLN, NEBRASKA, BERTRAM GROSVENOR GOODHUE, ARCHITECT

PUBLIC LIBRARY, INDIANAPOLIS, IND PAUL CRET, ZANTZINGER, BORIE AND MEDARY, ARCHITECTS

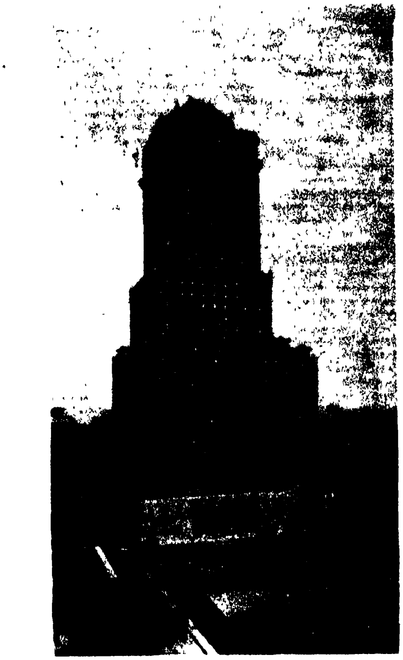
PUBLIC LIBRARY, BOSTON, MASS. McKIM, MEAD AND WHITE, ARCHITECTS

PEABODY MUSEUM, YALE UNIVERSITY,
DAY AND KLAUDER ARCHITECTS

MINNESOTA STATE CAPITOL, ST. PAUL, MINN.
CASS GILBERT, ARCHITECT

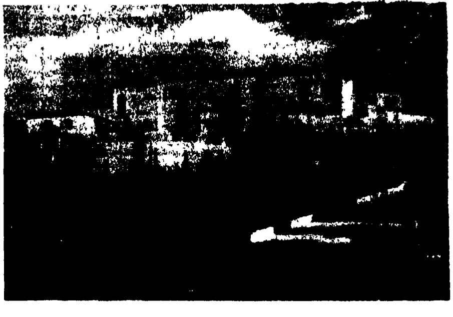


WOOLWORTH BUILDING, NEW YORK CITY,
CASS GILBERT, ARCHITECT



SHELTON HOTEL, NEW YORK CITY,
ARTHUR LOOMIS HARMON, ARCHITECT

PLATTHOUSE, GLEN COVE, LONG ISLAND,
TROWBRIDGE AND ACKERMAN, ARCHITECTS



HOUSE IN PASADENA, CAL.,
MARSTON, VAN PELT AND MAYBURY, ARCHITECTS

in a similar space of time at the beginning of the thirteenth and again in the seventeenth century, and in both the latter cases the start was from something fine in its own way, not from unspeakable degradation.

CLASSICAL FORMS ADAPTED SUCCESSFULLY TO NEW USES

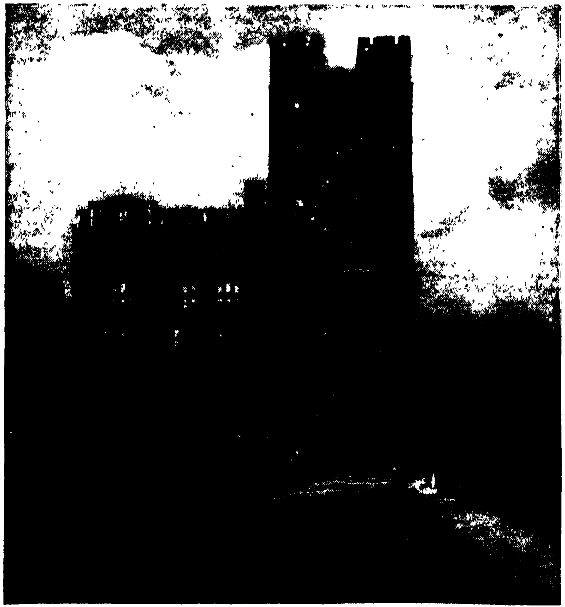
In the Classical field there has been no yielding, except in unimportant sporadic cases, to the degenerate approximations of Teutonic *"Art Nouveau"* or the Parisian absurdities of the Boulevard Raspail. The civic architecture of America is almost exclusively noble, dignified and self-respecting, from the new buildings in Washington, through the numerous state capitols, to the city halls, libraries and post offices of the whole continent. Classical forms are seldom used pedantically, but rather with freedom and suppleness and an unerring sense of beauty and propriety. In many cases these Classical precedents have been employed with an originality that is almost a continuation of tradition and life, rather than an imitation or a recreation, as, for example, the Indianapolis Library, or the Scottish Rite Temple and the Pan-American Building in Washington. Perhaps the most striking and vital of these works is the Nebraska State Capitol, one of the great masterpieces of modern art, while from a different field should certainly be drawn the Grand Central Railway Station in New York, first in the great galaxy of similar structures so expressive of American civilization.

The Gothic, or rather Medieval, movement has achieved equal originality, consistency and beauty. From its late English beginnings it has broadened out until it lays the whole period of the Middle Ages under tribute. English, French, Teutonic and Spanish Gothic all contribute something, and in addition there has been a rediscovery of Lombard and Romanesque architecture in all their grave dignity and almost naïve directness and simplicity. The archæological period has passed, and now architects are really thinking in the terms of the styles they use for inspiration and the times and the undying forces that brought them into existence. The new Christian architecture of America is full of reality, full of vitality, and where twenty-five years ago there were not five men who were working intelligently along this particular line, there now must be forty or fifty at least, mostly of the younger generation, and all doing work that is unquestionably the only living ecclesiastical architecture in the world, barring only England, where Sir Giles Scott still proves that the old mastery of the last half of the nineteenth century has not yet wholly passed away. Nor is this return to the Middle Ages confined to the historical churches, Roman and Anglican. Protestantism also has adopted the architecture of Catholic Europe as its own. Local conditions sometimes indicate Colonial or Georgian, but in every case this is immensely enriched beyond the old Puritan mode, while the liturgical arrangements are usually those of the Episcopal Church. In the West and Southwest the same influences suggest an adaptation and amplification of the primitive missions, but apart from Christian Science, Classical styles have been completely abandoned.

GOTHIC, TUDOR AND OTHER MODES IN THE UNIVERSITIES

This same Gothic movement has permeated the institutions of higher learning, and since Columbia University in New York, no college has accepted Classic as its mode of expression, though those that were preponderantly Colonial, together with preparatory schools of the same history, have gone back to their stylistic origins and are adding new work of very vital character. Generally speaking, as at Princeton, Yale and the University of Chicago, the one style is now some version of Tudor as this shows itself at Oxford and Cambridge, and superb indeed are the new creations, as, for example, in the dream-like Harkness Dormitories at Yale. The work of restoration really began at Princeton under Cope & Stewardson, it was continued at West Point in a more military style, and then the major part of the other great schools surrendered at discretion, always excepting Harvard, which, after a Babylonian exile among the alien gods of Victorian Gothic, "Queen Anne" and Richardson Romanesque, returned to the eighteenth century with most admirable results.

In domestic architecture there is still much of the old eclecticism, which is as it should be, the nation being what it is and its civilization what it is, but nowhere, not even in the great new field of commercial building America has now made wholly its own, have finer and more personal results been achieved, and this is true of all parts of the country. From New England, New York, Philadelphia, the Middle West, the Pacific coast have come new schools of house-building, all of them vigorous, personal, based on admirable precedents, full of beauty and distinction, and all hanging together in a way, though so different in their inception. It is doubtful if there has been any domestic architecture of so high a grade anywhere in the world, for certainly a century or more. In almost every case the work adapts itself with great sensibility to its environment and to the tradition and the personality, if not of the individual owner, at least to the general atmosphere of which he is a part, while the consideration of materials, textures and values, even if it is occasionally a little artificial, gives it a quality of extreme distinction.

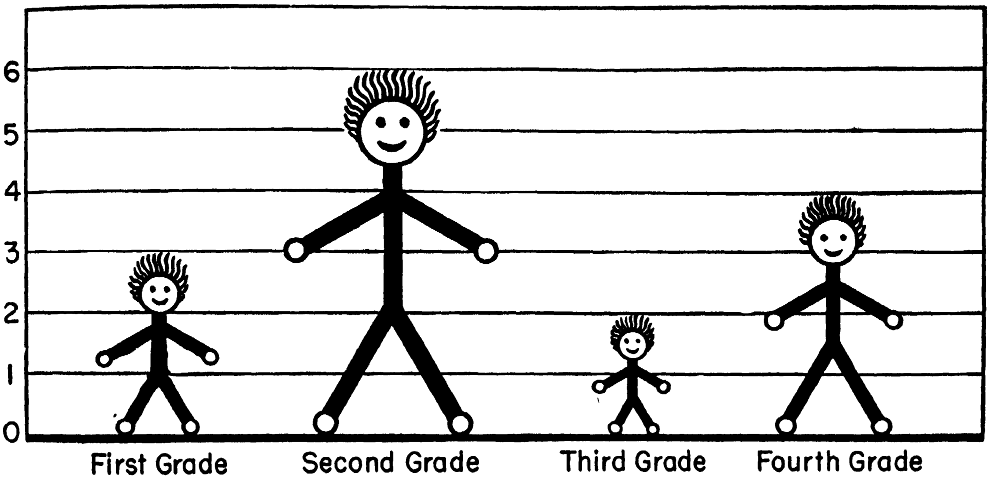


Post Headquarters, United States Military Academy, West Point, New York. Cram, Goodhue & Ferguson, architects.

In one direction American architecture during the last twenty-five years has achieved an eminence that is unexampled in recent times, and stands by itself in that it owes nothing to history or precedent and is wholly original. It would be impossible to overestimate the quality of the structures that at last have grown out of the use of steel and ferro-concrete. Here was a new combination of materials, one of them hitherto unheard of in history, that implied and demanded an entirely new architectural expression, not only because of the nature of the materials themselves, but because of what they made possible in the way of vertical expansion. At first there was no effort whatever at logical stylistic development, and the first steel-frame buildings were nothing but architectural imitations and subterfuges, intrinsically no better than the "jig-saw and batten" "Carpenters' Gothic" of the mid-nineteenth century. Little by little, however, and following the line first indicated by Cass Gilbert, something more rational and logical began to appear; twenty- or thirty-story buildings ceased to pretend to be of masonry construction drawn out to impossible heights, and took on something of the aspect of whatever they really were. The impossibility of permitting an entire section of a city planned for seventy-foot structures to be built up to a height of hundreds of feet, compelled rational cities to establish restrictions by means of setbacks, and so on, that immediately resulted in more or less pyramidal erections, and the result has been the unique and logical, and in a way strangely beautiful, architecture of business and commerce that has given New York a distinction all its own. It is one of the great triumphs of the art of building, and, without instituting comparisons or trying to fix ratios of value, it may justly be ranked with the other triumphs of a great art that have been recorded in history.

There is no better evidence of the essential vitality and dynamic force inherent in American architecture than this adaptation and development of the structure to meet new conditions of life and its activities. In the light of this manifestation it is possible to regard the architectural future with some complacency, as we turn from reviewing the long record of the architectural past.

THE NEXT STORY OF THE FINE ARTS IS ON PAGE 6695.



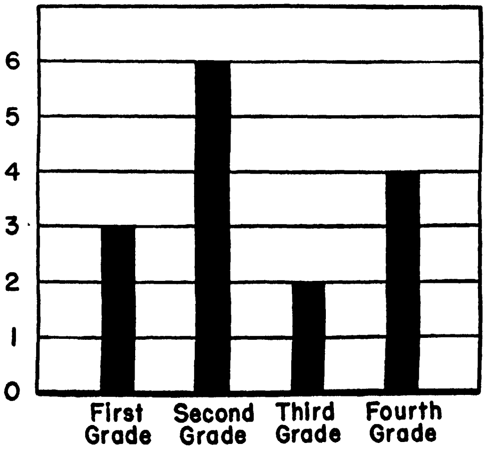
This graph tells us how many pupils had perfect records of attendance at school. First Grade, three; Second Grade, six; Third Grade, two; Fourth Grade, four. Graphs that use drawings as symbols are called pictographs.

WHAT IS A GRAPH? HOW IS ONE MADE?

A GRAPH is a special sort of diagram or picture. When you want to compare quantities or numbers, a graph will generally make your story clear at a glance. Graphs can help us to understand and even to enjoy the sets of facts and figures that we call statistics. Moreover, graphs can condense an amazing amount of information in a very small space.

There are several kinds of graphs. The ones you see most often are line graphs, pie graphs, bar graphs and clever pictographs. Many pictographs have lively little pictures as symbols.

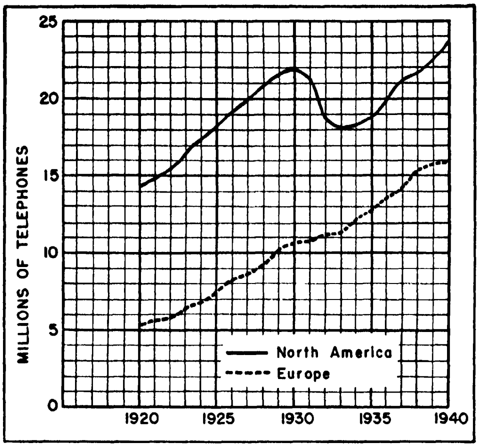
For instance, the dashing young pupils at the top of this page give us an example of one variety of pictograph. Compare this graph with the one at the right, which is drawn with vertical bars instead of pleasant pictures. Both graphs tell us the same story: the number of pupils in Grades One to Four who had perfect records of attendance. In this case, the bar graph makes its point in the same way that the pictograph does, in spite of the fact that the two graphs may seem, at first glance, to be quite different. Many pictographs are simply bar graphs "all dressed up."



Here, bars are used instead of pictures to tell us how many pupils had perfect records of attendance.

Some graphs are best for one subject, some for another. In bar graphs and pictographs we can compare sizes and amounts of almost anything, from national incomes to bushels of corn. Line graphs are usually best for showing the ups and downs of progress over a period of time. When we wish to show the relation of parts to a whole we should do better to make a pie graph.

Graph paper helps us make accurate graphs. This paper is printed with evenly spaced squares. Some kinds have every fifth square heavily inked, as we see on the next page.



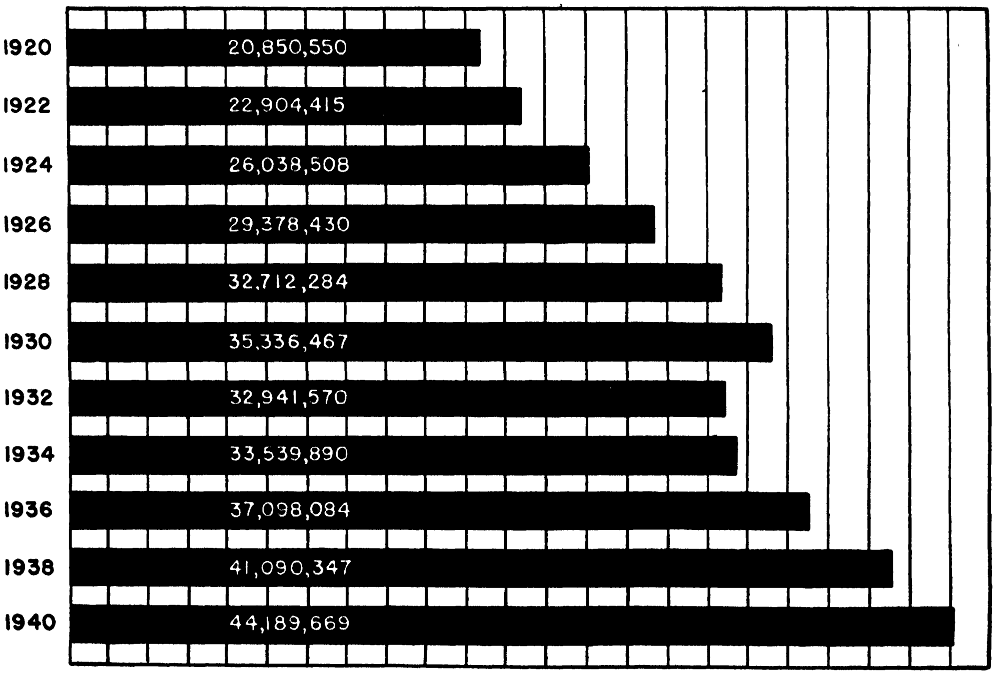
The two lines or "curves" in this line graph make an interesting comparison. Note how the upper line dips while the lower one rises more steadily.

In making line graphs, you will find that graph paper is a great help. In many line graphs the horizontal lines tell us the number and the vertical lines tell us the years, as they do in the example above. In making such a graph, first locate the points where the year-line you want crosses the proper number-line; then mark these points with dots. (Finding and marking these points is called plotting.) Now draw a line connecting each point with the one that is next to it.

When only one subject is to be shown you have only one line to plot. You can compare two or more subjects on the same graph, however, by plotting two or more lines. In this example we have drawn a solid line for one set of facts and a broken line for the second set. If you wish to plot several lines on one graph, a good way to do it is to draw them with crayons or colored inks. Then you can give each line a special color of its own.

This line graph tells two stories. The upper line shows the number of telephones in North America from 1920 through 1940. The lower shows how many telephones there were in Europe in these same years. The caption at the left of the graph tells you that the figures from bottom to top stand for the number of telephones in round millions. Beginning at the 5,000,000 mark, every fifth million is labeled. Read the number-lines in between by counting from the ones that are labeled. Count one line up from the 5,000,000 mark and you reach the 6,000,000 line. Next is the 7,000,000 line, and so forth.

The figures along the base of the graph



Horizontal bar graph showing the exact number of telephones in the world in various years from 1920 to 1940.

give the years from 1920 through 1940. After 1920, every fifth year is labeled. The vertical line to the right of 1920 is the 1921 year-line; the next to the right is the 1922 year-line, and so forth.

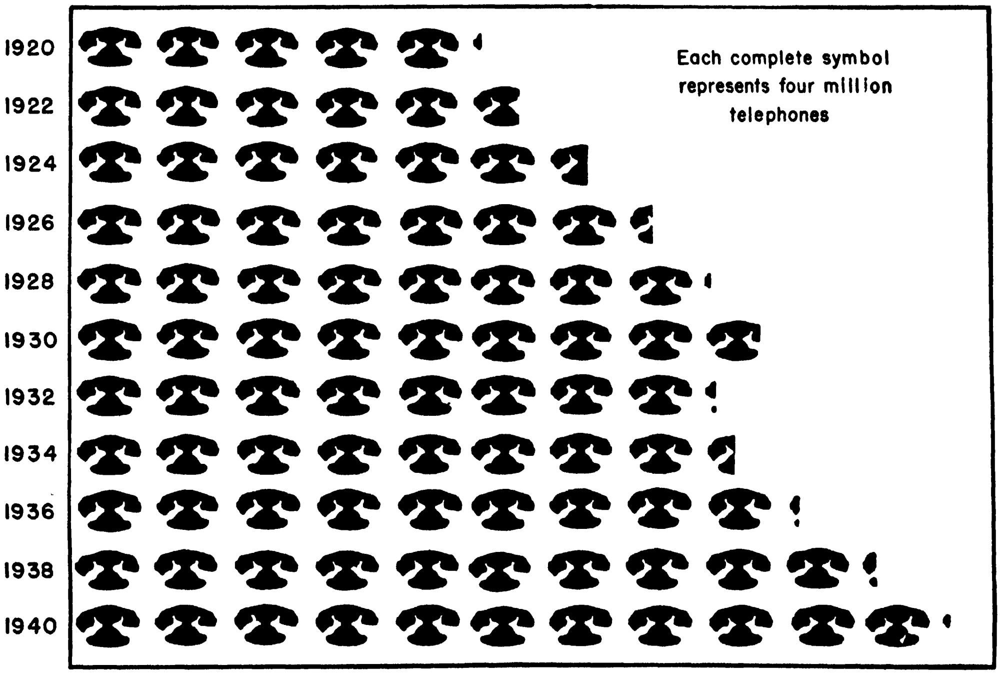
Line graphs bring out even slight gains or losses over a period of time. In our example (opposite page) the "Europe" line shows a fairly steady upward progress, and yet in the 1930's it hesitates and very nearly flattens. Those were the years when there was a great financial depression, and very few Europeans could afford to put in new telephones. During these years the "North America" line takes a tremendous dip, for many North Americans could no longer afford to own telephones and had to give up the ones they had.

In some kinds of work, there is need to show the progress or development of a number of things at the same time. When accuracy is important, the line graph is by far the best. For instance, line graphs are the only ones that are serviceable in scientific and engineering work where careful records are a necessity. Such technical line graphs can be so complicated that only people with special training can interpret them.

Line graphs have the great advantage that it is so easy to add further information as time goes on—hour by hour, or day by day, or whatever measure of time is wanted. As a result, line graphs are valuable in keeping records of experiments that are in actual progress. Line graphs were developed by a man with a brilliant mind—the great French philosopher Descartes. He found that the plotting of mathematical curves was a great help in the study of higher mathematics.

Pictographs serve us in many ways. They can be so dramatic that we remember them for a long time; and they are perhaps at their best in making general or rough comparisons. Both bar graphs and pictographs can usually be adapted to bring out whatever point we want to emphasize the most.

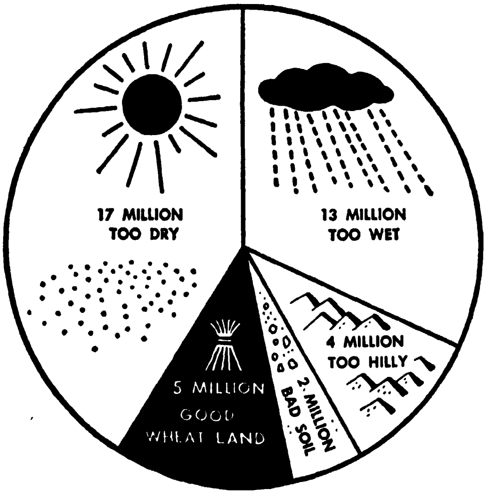
Compare, for instance, the pictograph on this page with the bar graph opposite. They deal with the same subject, the same years, the same figures. Their emphasis, however, is slightly different. In this case the bar graph is exact; the pictograph is not. Here, the bar graph states the figures in full, with each bar plainly labeled. In this particular pictograph, exact figures are not given. Each of the little symbols stands for 4,000,000 telephones. Fractions of this number are shown by fractions of the symbol.



To give a rough idea of the number of the world's telephones in various years, this pictograph serves very well.

The circular graph is also called a pie graph—you can easily see why. Pie graphs are of especial value in school work. You will find them in many geographies, atlases and history textbooks. These graphs are divided into slices to show the relation of the various parts to the whole.

PICTURE PIE GRAPH—EASY TO UNDERSTAND, EASY TO REMEMBER



Graphic Associates

The whole "pie" totals 41,000,000 square miles.

To make the slices of the pie in correct proportions we use a drawing instrument called a protractor, which is marked with the degrees. The entire circle represents 100 per cent; each slice is a percentage of the whole. We may label each slice with its percentage if we wish to, as you see in the example that tells about the population of the world as a whole. We may prefer to label the slices with figures, instead, as you see in the pie graph at the top of this page. In this case, if you add the given figures you will find that they total the whole figure, which is 41,000,000.

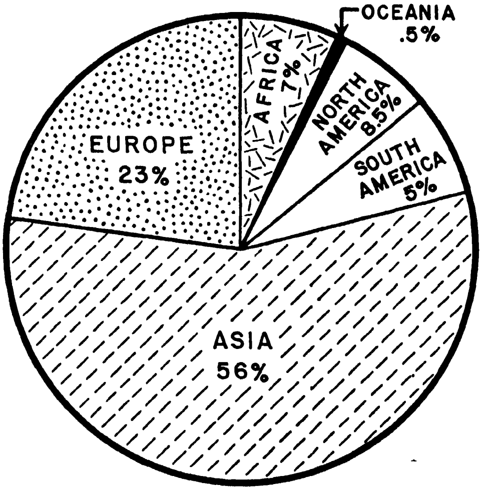
Altogether, there are 41,000,000 square miles with the right temperature and the right altitude for growing wheat. In our pie graph, the entire pie stands for this entire figure. Unfortunately, however, many of these acres can not be used for wheat-growing. In fact, most of this land has one thing or another the matter with it. Some of the acres are too dry; some are too wet. Others are too poor or too hilly. Of all this vast area there are only 5,000,000 square miles that are good for growing wheat.

The small amount of good land is made startlingly clear in this pie graph by the small size of the slice marked "Good Wheat Land." Here, as in all pie graphs, the slices are the real workers that make the proportions clear. The drawings of a shining sun, a raincloud, rubble and hills serve an entirely different purpose. Although they do not tell us anything about the sizes of the various acreages, they are important in attracting attention. By adding a touch of drama, they are of great use in impressing the facts on our minds.

By contrast, our second pie graph seems very plain and sober. Yet its message is equally dramatic. The entire circle stands for the world's total population. The slices give us a vivid idea of the way this total is divided throughout the world.

The slice marked Asia is by far the largest. Fifty-six per cent, or more than half, of the people in the world are crowded into this one area. How tiny, in comparison, is the population of the great continent of North America! Even the entire population of Europe is small in comparison with the gigantic population of Asia. The slice representing Oceania is so small that its label had to be placed outside the pie, as you can see. Oceania contains one half of one per cent of the world's total population.

SHADING HELPS TO MAKE THE "SLICES" STAND OUT CLEARLY



The population of the world shown in a pie graph.

By E. C. McDowell.

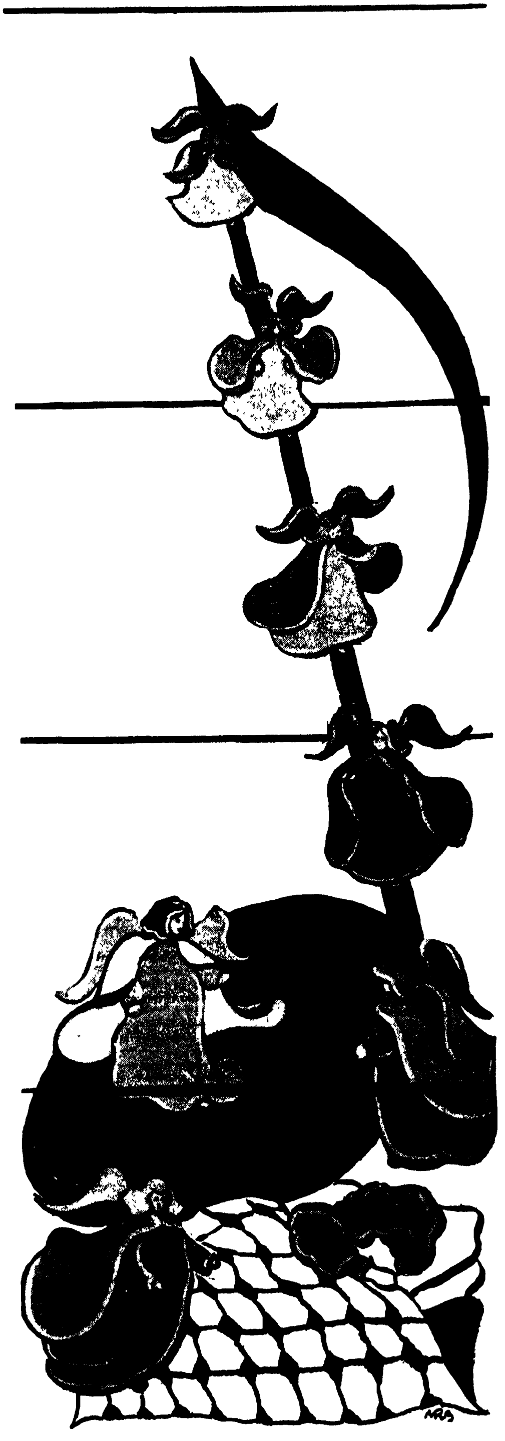
THE NEXT WONDER QUESTIONS ARE ON PAGE 6882.

WONDERFUL, WONDERFUL MUSIC

THE great art of music is a strict science having perfectly definite laws based on the facts of sound. The music of long ago consisted entirely of melody—that is to say, tunes which are usually very simple, and have only one note sounded at a time. However, it is very pleasant to the ear sometimes to hear two or more notes sounding at one time; also, that can be very unpleasant. When the sound is pleasant we call it harmony; when it is unpleasant we call it discord. The development of music is largely the story of progress in harmony. Let us discover, if possible, what makes harmony and what makes discord. The difference to our ears is very great, and there surely must be some rule having to do with the nature of sounds.

Here is another thing to note—there are certain kinds of harmony where the notes sounded together seem so much alike that we do not even speak of them as making a harmony. For instance, two different C's on the piano have certainly not the same sound, yet they have a curious likeness, a family resemblance. Does this depend on their being near to each other? No, a C sounds very much like another C, even perhaps two or three octaves away, and unlike a note next to it, such as B, or C sharp. This we soon notice if we sound together two C's, then two notes next to each other.

The great law is that the ear judges by relations, or to use the proper word, ratios. When we compare any harmony with any discord, the difference is in the ratios, or relations, between the numbers of the notes. We know that every possible musical note means a definite number of airwaves striking the ear in a single second of time. On the relations between those numbers all harmony and, indeed, all music depend. The simplest possible relation between two numbers is plainly the relation of 2 to 1. Nothing else



could be quite so simple as that, unless the two numbers are actually the same. Now this relation of 2 to 1 gives our ears the impression of the closest resemblance and harmony that are possible. Two notes making an octave have this relation between them, and no matter where in the scale we take them, they will always have the same effect on the ear. One note may have 24 vibrations a second, and the other 48, or the numbers may be 15,001 and 30,002, but their ratio is as 1 to 2, and so the one sounds almost like the double of the other.

MOST OF OUR MUSIC IS BASED ON A SCALE OF EIGHT NOTES

Most music is based on this fact, and by filling in the interval between the one note and the other with a varying number of other notes chosen in a certain way, we form what is called a scale. Nothing would be easier than for a player on the violin to play a scale, or any number of scales, which we should call hideous. On the other hand, there are certain scales which the ear likes very much. Some of them have the effect of being mournful, and some of being untroubled or even gay.

Ever since music began, and in all parts of the world where it has existed, it has depended on the use of a scale, or set of notes. For instance, one set of notes was used long ago in England and in Scotland, certain sets were used in Greece, and certain sets are used today in India and China.

In every case the particular set or sets of notes make up the alphabet of the musician. A clever musician can at once tell when he hears a tune, like one of the beautiful old Scottish tunes, to what period it belongs and from what place it came, because he recognizes the scale from which the composer has chosen his notes.

THE ONLY SCALE THAT IS PLAYED ENTIRELY ON THE WHITE KEYS

Let us first look at the ordinary scale that we can play on the piano by simply touching the white notes from C to C. To our ears, accustomed from our earliest years to hear this scale, and to hear tunes made from it, this sounds natural, and any other scale at first sounds rather peculiar and less natural. But every musical scale has its definite laws, always to be found by studying the vibration numbers of the notes that make it. To this we must add that the numbers themselves are of no importance; the whole point is the relation between them. Any kind of scale may start on a note of any number, but all the other notes in the scale will have a fixed relation to that number, and those relations make the scale. We shall recognize it, and it will have the same effect on our ears whether it is played in a low key or a high one; it will be the same scale, whether played by a bassoon or a flute or a violin.

HOW TO WORK OUT THE RATIOS OF THE SCALE OF C MAJOR

It is quite easy to write down exactly the ratios of all the notes in the ordinary scale of C major, which most of us know so well. Let us suppose that the lower C happens to have a vibration number of 24 per second; it might just as well be 25 or 250½ per second. But 24 is a convenient number, and, if it is 24, then we can find out exactly what all the other numbers will be. Here they are set out in order and showing their relation:

C	D	E	F	G	A	B	C
24	27	30	32	36	40	45	48

Now, there is no point in these numbers themselves, but there is point in the relation existing between them. The first thing we notice, of course, is that the ratio between the two notes that make the octave is the ratio of 24 to 48, and that is the ratio of 1 to 2. The next simplest ratio that we can notice is that of C to G, for C is 24 and G is 36, so that the ratio is that of 2 to 3. One more ratio we may note, the ratio of C to E, which is that of 24 to 30, or 4 to 5.

THE COMMON CHORD WITH WHICH SO MANY PIECES END

Now, if we take the notes that we have observed, C, E, G, C, we find, to begin with, that they make the common chord, the sound which we all know so well, for most pieces of music end with it. If it comes in the middle of a piece of music, we are likely to think that we have reached the end.

That is the peculiar quality of this wonderful chord: it sounds final. After other combinations of notes the ear expects more. But the ear is always content with this; it requires nothing to finish it or carry it on. Now, in the case we have chosen, the vibration numbers of these four notes are 24, 30, 36 and 48. If we reduce these we see that the ratios are those of 4, 5, 6 and 8. Now, it does not matter where we hear a common chord or what note it starts on, the ratios of the four notes making it are always those of 4, 5, 6 and 8.

If we look at 4, 5, 6 and 8 on a piece of paper and study them, we are studying arithmetic, a simple branch of mathematics. Its laws apply directly to some of the deepest and most wonderful feelings of which we are capable. Considered in themselves the ratios 4, 5, 6 and 8 are quite dry; they seem to have nothing to do with mankind. Yet all over the world, in all ages, men have only to hear this ratio, called a tetrachord, made in sound-waves and they receive a certain set of definite impressions. To trained and untrained ears alike the ratio means music as distinguished from noise; it means harmony as distinguished from discord; and it has the peculiar quality of saying, "This is the end," not merely pleasing the ear, but satisfying it.

If we went further into the matter we should find that there are other ratios which always tell the ear that there is more to follow; yet the absolute difference between these two qualities depends on abstract arithmetic—the difference between the ratio of one set of numbers and the ratio of another set.

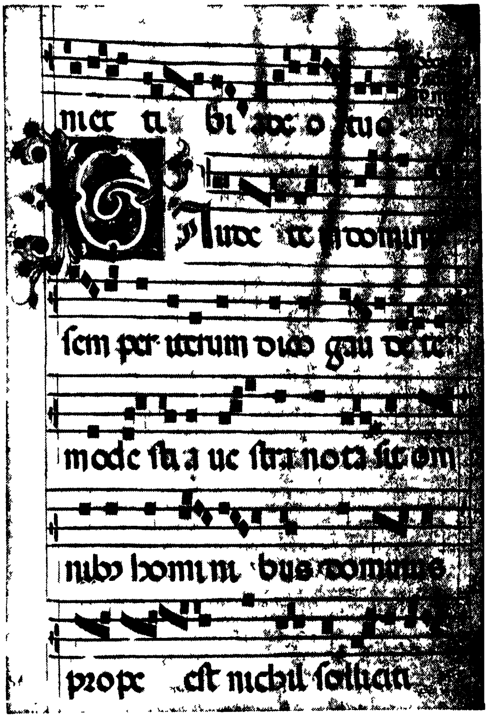
HOW THE SCALES CORRESPOND TO DIFFERENT HUMAN EMOTIONS

These simple facts, so well known to all musicians and students of sound and of the ear, are full of the highest meaning if we have wisdom to see it. Anyone who had not thought wisely and deeply about the world would have supposed that no two things could be farther apart than, on the one hand, our feelings of yearning and satisfaction, or sadness and joy, and on the other hand, the arithmetical ratios between a certain set of numbers. Yet these two utterly different and unrelated things, as they seem to be, are eternally bound together by the laws of nature and of man. Let us now print again the notes of the scale and their vibration numbers in the case where we happened to start with 24, and underneath these let us print the ratios of these numbers:

C	D	E	F	G	A	B	C
24	27	30	32	36	40	45	48
1	$\frac{9}{8}$	$\frac{5}{4}$	$\frac{4}{3}$	$\frac{3}{2}$	$\frac{5}{3}$	$\frac{15}{8}$	2

We notice that these fractions vary in simplicity. The simplest is the fraction corresponding to G, and the next simplest is that of E, which is just halfway between C and G. These give us the common chord. It is very interesting to notice that one fraction in the above list is very decidedly less simple than any of the others—that is the fraction $15/8$, corresponding to the note B in the scale of C.

Now, we are all quite able to sing a scale, and it is quite natural to us to strike the last note but one, which in this case is B. But when we have noticed that this ratio is really the least simple of them all, it is very interesting to learn from the history of music that this particular ratio had to be discovered.



A page from a fourteenth century antiphonary, or book containing music for the responses sung in church. It shows the curious square notes which gave way in the following century to diamond-shaped notes. To these were added tails showing the time value. Not long after, the modern style arrived.

It appears that to whatever part of the world we go we find a time when the ears of musicians had not discovered this ratio as a way of getting from A to C. So they stopped at A. Very often, also, they had not discovered the ratio $4/3$, which corresponds to F. So it was that they had simply a scale made of five tones: C, D, E, G, A. This is the very famous five tone, or pentatonic, scale, which we may say was the great scale of music until comparatively recent times, and the discovery of F, and more especially of the difficult ratio B, from which the scale can climb to a note exactly double of the note it started with, and so finish beautifully.

There is no end to what might be learned about the different kinds of scales, but what has been said gives us the key to the wonderful facts; and we discover that music may really be looked upon as a branch of applied mathematics, an application of the laws of the ratios of numbers.

WHY WE SAY THAT A NOTE IS OUT OF TUNE

When we are playing a scale of any kind on the piano or on the violin, or when we are singing it, perhaps one of the notes we make sounds quite wrong, and we say that it is out of tune. What does this mean? There is nothing the matter with the note itself. It may in itself be a lovely note, rich and clear, brilliant or tender. Nevertheless, where we hear it—perhaps in a scale or in the course of a song or a piece—it comes to us as a sort of shock.

The reason is that the vibration number of that note does not have the ratio it should have to the other notes. It is out of tune with them, or we might say that they are all out of tune with it. Anyway, the ratio is wrong. If it is wrong because the vibration number is too small, we call the note flat; if the vibration number is too high, we call the note sharp.

One of the commonest mistakes in singing and in playing the violin is to make the notes flat. No matter how beautiful the voice or the tone of the violin, no matter how expressively played, no matter how good the rhythm, how well judged the varieties of time or anything else, no one can enjoy music that is out of tune. Everything else may be right, but if the arithmetic is wrong, the result is not music.

THE MEANING OF THE BLACK KEYS ON THE PIANO KEYBOARD

What is the meaning of the black notes on the piano, lying here and there between the white ones that make the scale of C? In the course of the development of music, a second great stage has been reached. The first great stage was when the five-note scale was improved into the ordinary scale we know so well.

The next great stage was to add five more notes at certain places in between pairs of the notes of the ordinary scale. If now we play all these notes in order on any instrument, we get exactly the same sound and result as when we play all the notes on the piano, one after the other, including the five new black notes with the older white ones.

On this new scale the distance between any two notes is much less than it is in the simpler scale. For instance, if we look at our table, at E, F and G, we see that from E to F it is only half as wide a space as from F to G. Well, in the new scale with the black notes, a black note, which we call F sharp, has been put in between F and G, so that the intervals from E to F, from F to F sharp, and from F sharp to G are equal. The older scale, made by the white notes, is known as the *diatonic* scale, and the newer one, with the black notes included, is called the *chromatic* scale.

GREATER VARIETY IS OBTAINED WITH THE CHROMATIC SCALE

If now we compare the three scales, pentatonic, diatonic and chromatic, we can understand something of the development of music. Not a great amount of variety can be yielded by the oldest simple scale. The results may have been lovely, but they were limited. It is this lack of variety that makes the difference between the diatonic scale and the chromatic scale.

During the last few hundred years the chromatic scale has become the basis for composition. It is easy to understand that when children are learning music the tunes they enjoy and understand first are based on the simpler scales. Everyone enjoys these tunes. But it requires a better-trained ear to fully enjoy the music built on the chromatic scale.

If we chose to write all music down in the form of arithmetical ratios, which might be done, it could doubtless be shown how people can be classed according to the development of their musical ear by nature and education, beginning with those who can follow simple ratios like 2 to 1 and 3 to 2 and 5 to 4, and ending with those who can follow the more difficult ratios that are used so much in modern music.

THE MARVELOUS TONE QUALITY OF STRINGED INSTRUMENTS

Stringed instruments have an exceptionally beautiful musical tone; and the behavior of stretched strings is, in any case, so interesting that it has been very carefully studied. If we look at a violin and notice how it is used, we shall see that there are three facts about a string which decide the rate at which it vibrates.

To begin with, we notice that the strings which make the lower notes are thicker than those which make the higher. The rate of vibrations of a heavy string is less than that of a light string. The heaviness, or, rather, the mass, of a string will depend partly on the density of the material and partly on the thickness of it.

Secondly, we notice that it makes a difference to the violinist how tight his strings are. When he tunes his instrument he is turning the pegs which decide how tight the strings shall be. The tighter the string, the more quickly it vibrates and the higher the note becomes. If we increase the tightness by 4, the string vibrates twice as often; if by 9, it vibrates 3 times as often—4 being 2 multiplied by itself and 9 being 3 multiplied by itself. That is the law for all cases.

Lastly, we notice that when the violinist plays he is constantly moving the fingers of his left hand and pressing on the strings. This is simply the most convenient way of altering their length, for when he presses on, or stops, a string at any point it is just as if the string stopped there altogether. We also notice that when he is playing high notes his fingers come farther toward the bridge to make the strings shorter. The shorter the string, the higher the note.

There is a deeply interesting question which we have not yet discussed at all. Let us suppose that the C of the piano is 24, as we did before. Now, we may have an organ and a violin and a voice, and many other kinds of instruments, all sounding this same note, and yet the sounds are very different. Everyone would instantly know which was the note made by the violin and which was the note made by the piano.

Clever people, too, can tell one piano from another, and it is often easy to tell one violin from another, and we can all tell the voice of one friend from that of another. This is true even though it is the same note that is being sounded in all these cases, and it is very interesting to discover where the difference lies.

Photo by Victoria and Albert Museum

The Village Choir, painted by Thomas Webster, a nineteenth century English artist. It is in simple groups such as this that the musical life and talent of a nation often has its growth.

To begin with, there are some kinds of musical instruments where the differences are not to be found. Tuning forks, for instance, professing to sound the same note, really do sound the same note, without the difference that there is between a cheap violin and a good one. On careful study we find the reason for this difference. In the case of a tuning fork the sound-waves are perfectly simple; but in the case of a violin or a voice or a piano or an organ pipe, it is rather as if the waves were like big billows of the sea with little ripples on them, and with perhaps tinier ripples on these ripples, if our eyes could see them.

Now, it makes a very great difference to our ears whether sound-waves are simple, like a line simply waving plainly up and down, or complicated, with all sorts of smaller waves mixed up with the main wave. All the sounds that are valued in music are made up of these mixed waves. The main wave is called the fundamental note, or tone, and all the other small waves which go with it are called overtones, or harmonics.

THE PART PLAYED IN MUSIC BY THE OVERTONES

These overtones are interesting equally to the student of sound and to the student of music. It is the quality, the number and the relative loudness of the overtones that make the difference between one instrument and another, and one voice and another, even though they are all sounding the same fundamental note. This means that nearly all the musical notes we hear are really not single notes so much as combinations of notes. They are really harmonies, only we scarcely notice them as such because the lowest note of the chord is so very much louder than all the others; yet they are harmonies, and they make all the difference between the sound of the violin or of the piano, the voice of one friend and that of another.

The great interest of music written for various instruments and for various kinds of voices consists in the endless variety that we are able to get by using one instrument with another kind of instrument which has different overtones. Whatever the instrument employed, we desire that its overtones shall be many and rich and harmonious. This is most notably true in the case of the violin and the human voice.

We all know that some violins made many years ago are worth thousands of dollars, while others may be worth only a very small sum. No matter whether we have the same player, the same bow and the same strings in the two cases, the one violin will make a rich, lovely musical tone, and the other a thin, scratchy noise which can hardly be called music. All this is a question of overtones. Somehow or other, one and the same string, played by the same bow, by the same hand, in the same room, produces lovely tones or ugly tones in the two cases, though the name of the note is the same.

THE SECRET OF MAKING THE TONE OF A VIOLIN LOVELY

There is something, then, about the body of the violin which makes all the difference, and this is now understood. The string is making not only the big main wave itself, but also the little waves. The secret of making the sound lovely is to have near the string something which can be made to vibrate when the string does, and it must be something which has the power of picking out from the string-waves just those overtones which the ear likes best; then the tone will be enriched. In the wonderful violins of old the front and the back of the body seem to be made of exactly such size and shape, curvature and thickness that they both resonate in just the same way and to just the same notes. They help each other instead of fighting each other. Now we may be able to understand why some old instruments are so highly prized.

THE FAMOUS VIOLIN-MAKERS OF ITALY

The greatest of the old makers of violins were Italians who worked at Brescia, Cremona, Venice and Naples. Andrea Amati, of Cremona, who died in 1650, made many good instruments, but was surpassed by his sons Antonio and Geronimo, and his grandson Nicolo, who was the greatest of the family. The last-named took many pupils, but his favorite was Antonio Stradivari, to whom he left his tools, models and all his stock of choice wood. Stradivari is called the greatest of all makers of violins. He did his best work between 1700 and 1720, and one of his fine instruments will bring thousands of dollars. He had two sons who also made excellent instruments. Antonio Giuseppe Guarneri del Gesù, who was a young man while Stradivari was at his best, made violins which some think are equal to those of Stradivari. This great violin-maker was called del Gesù, which means "of Jesus," because of the fact that the inscription I. H. S. (*Iesus hominum salvator;* "Jesus the savior of mankind") is to be found on the labels of his violins. Guarneri del Gesù was the most renowned of a family of violin-makers all of whom dwelt in Cremona.

THE MASTER VIOLIN-MAKERS OF VENICE

At Venice, Francesco Gobetti and Domenico Montagnana made beautiful instruments, and Ferdinando Gagliano, of Naples, was the most noted of a large family of violin-makers. Men in other Italian cities, and a few from northern Europe, learned from the masters at one or other of the four towns. The most famous German was Jacob Stainer, a pupil of Nicolo Amati. French and English violins of the time are not considered equal to the Italian.

THE NEXT STORY OF FINE ARTS IS ON PAGE 6767.

The United States Corps of Cadets on the Parade Ground at West Point.

WEST POINT AND ANNAPOLIS

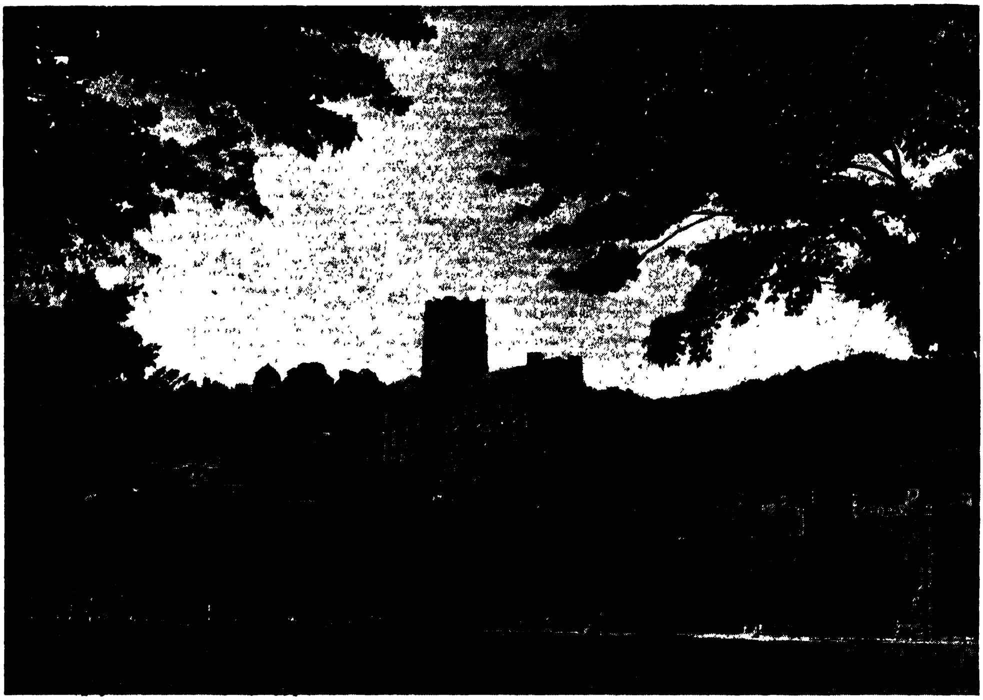
YOU have all heard a great deal about generals and admirals and colonels and commanders and lesser officers. Perhaps you have read that some of them had had something to do with West Point or Annapolis. Possibly you have wondered what connection these places have with soldiers and sailors, and have wished to know what and where they are, and what goes on there.

West Point and Annapolis are the familiar names of two famous government schools to train officers for the Army and Navy. The United States Military Academy is at West Point, New York, and the United States Naval Academy is at Annapolis, Maryland. Few people ever use the whole name in speaking of either of these schools, but use instead the name of the place where it is situated, and we shall follow their example, after telling a little about the settlement of West Point itself.

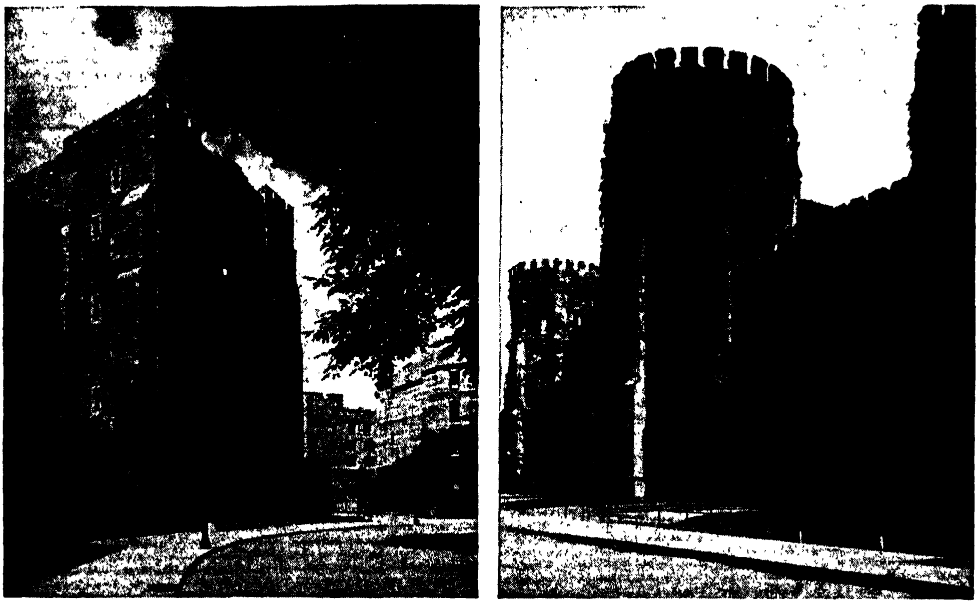
At the beginning of the Revolution Congress decided to fortify the Hudson River, so that the British could not separate New England from the other states by getting control of the river. Fifty miles above New York the river breaks through the Highlands in a winding gap, and on the right, or west, bank the land juts out in a point, and from this comes the name, West Point. Here several fortifications were built. It was these fortifications that Benedict Arnold intended to betray to the British, who did not seem to be able to take them by force. But Arnold, as we know, was not successful in his attempt. After Arnold's treason the name was changed to Fort Clinton. At the end of the Revolutionary War the fighting men who had volunteered for the war went home. The American army was reduced to eighty men. These were stationed at Fort Clinton and all military supplies were collected at the fort.

When Washington became president he wished to establish a training school for officers, but very little was done. On March 16, 1802, after Jefferson had become president, the Academy was founded. The War of 1812 called upon the cadets to serve, and the Academy almost died, since no appointments were made to replace them. In 1813, new appointments were made and in 1817 in President Monroe's administration, the school was placed upon a firm basis. President Monroe appointed Colonel Sylvanus Thayer superintendent of West Point. Colonel Thayer, who is known as the Father of the Military Academy, reorganized the

IN SIGHT OF THE BEAUTIFUL HUDSON



The buildings of the United States Military Academy at West Point, New York, are imposing, and the views from the grounds are superb. You can see the Hudson River where it breaks through a gap in the Highlands. Here is the beautiful Cadet Chapel, built on an elevation. In the background is a glimpse of the observatory.



The picture at the left is of the Cadet mess, Washington Hall. At the right you see the library, with the towers resembling the towers of some medieval castle. Ivy covers the older buildings to the very top, and on the newer halls it is making headway, softening the appearance of the heavy stone walls.

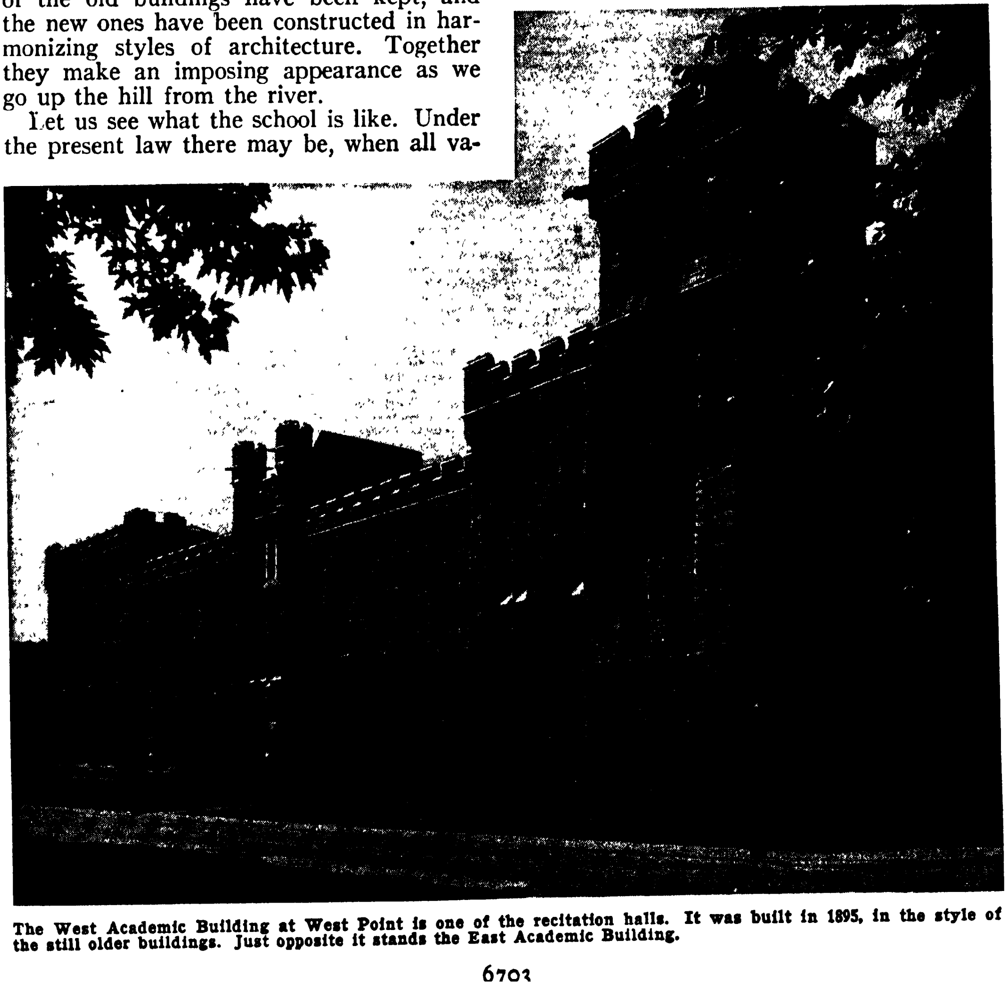
school, modeling it, as far as studies were concerned on the Ecole Polytechnique of France, and following Napoleon's military theories in its arms training.

We cannot tell of all the gallant young graduates who served in the Mexican War. Grant, Lee, Sherman, Hancock, Thomas, Meade, Stonewall Jackson, Albert Sidney Johnston, Joseph E. Johnston and many others who later won fame in the Civil War, were all graduates of West Point and served first in the Mexican War or in the Indian wars. Most of the higher officers of the United States Army were trained at West Point, but not all.

But we cannot stop to tell more of old West Point, as there is so much to tell of the new. The Academy has been enlarged a number of times. The latest building programme was completed in 1939. The best of the old buildings have been kept, and the new ones have been constructed in harmonizing styles of architecture. Together they make an imposing appearance as we go up the hill from the river.

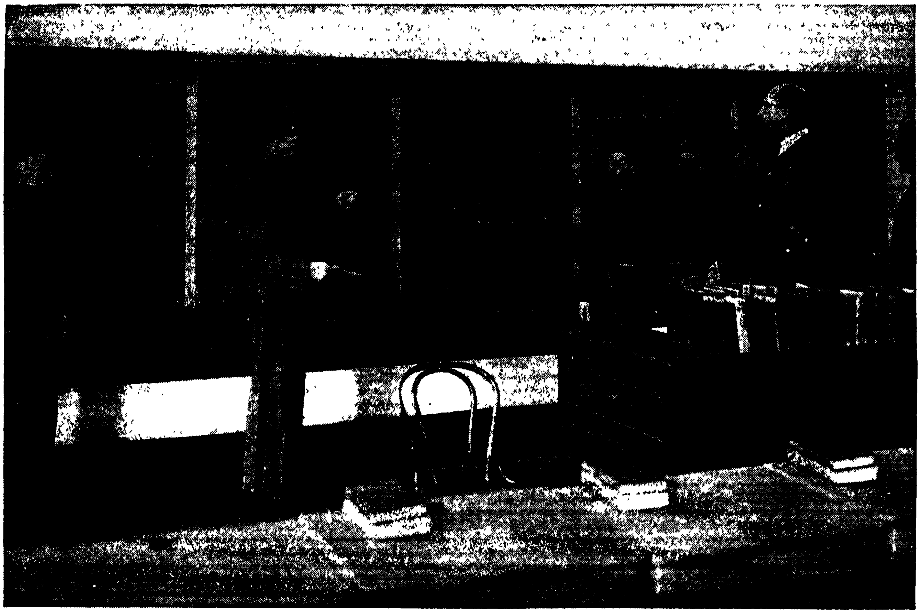
Let us see what the school is like. Under the present law there may be, when all vacancies are filled, 2,496 cadets. Four are appointed by each member of the House of Representatives, 4 by each Senator, 4 each are appointed from Hawaii, Alaska and Puerto Rico, 6 from the District of Columbia and 2 from the Canal Zone. The President selects about 90 candidates, very often the sons of army or naval officers; the Vice-President chooses 3. Forty are appointed from the graduates of certain military schools, and 180 from the Regular Army and National Guard together; 40 from the sons of World War I and World War II veterans killed in action or dying of wounds or diseases contracted in line of duty during the war. Appointments are made only to fill vacancies as they occur. Many of the young men are appointed by means of competitive examinations held in their state.

No one can be admitted who is under sev-

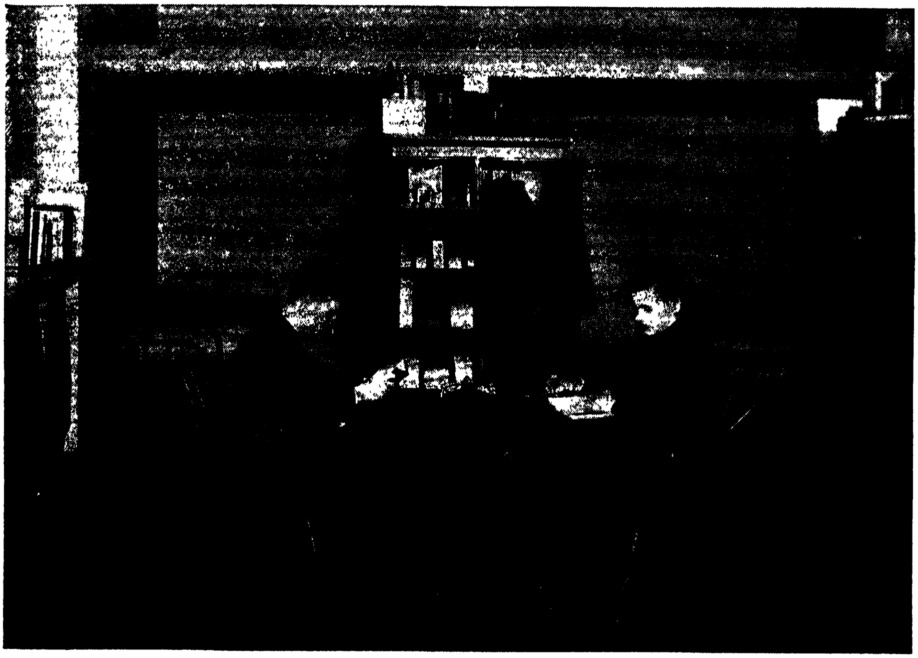


The West Academic Building at West Point is one of the recitation halls. It was built in 1895, in the style of the still older buildings. Just opposite it stands the East Academic Building.

HOW A WEST POINT CADET LEARNS



When a cadet has finished his problem he turns toward the instructor and stands at attention until called upon to recite. Then he turns to the blackboard and explains his work. If his work is correct and his explanation full and clear he receives a high mark, but if the instructor must ask a question to make the explanation clear, a deduction is made, even if the work is correct. The instructors are chiefly officers.



Two cadets are assigned to a room, which they must keep in order themselves. Everything must be in its proper place, and neither must use the other's things. The beds must be left exactly as the rule requires. The regulations fix exactly the place where towels, soiled clothes, and even whisk-brooms must be kept. No litter is allowed, and each cadet must post his schedule showing where he may be found.

enteen or more than twenty-two years of age, except World War II veterans, who are eligible until they are twenty-four. A candidate must be at least five feet, four inches tall, when seventeen, and five feet, five inches if older. He must have no disease or deformity, and must be strong and vigorous.

THE COURSE OF STUDY LEADS TO A DEGREE IN SCIENCE

Candidates for appointment are examined in March, each year. Certificates are accepted from certain schools approved by the War Department. If a young man is admitted he reports to West Point on July 1, and becomes a member of the fourth, or "plebe" class. All summer he is drilled, first while living in the barracks and then in summer camp in tents. In September all the cadets move back to the barracks, and regular recitations begin. The course lasts four years and is very hard. The objective of the Military Academy is the education and training of young men for the career of arms, as officers of the regular Army of the United States.

Academically, West Point is a school of technology, and its graduates receive the degree of Bachelor of Science. The course includes a great deal of mathematics, besides physics, engineering, science, French and Spanish, law, English history and drawing. The cadet must study drill regulations, ordnance and gunnery, and other things which a soldier must know. He must go to the gymnasium, and must learn to swim and to ride. Every day is full of its duties, and yet no students have a better time than the West Point cadets.

HOW THE CADET'S FOUR YEARS ARE FINANCED

While the Military Academy is a government institution, and tuition and lodging are provided without charge, the cadets, like Army officers, must pay for everything they personally wear, eat and use. Cadets are paid $65 per month, and commutations of rations at seventy-five cents per day, totaling $1,053.75 each year. Cadets do not handle their pay; it is credited to their account and their expenses are charged against it. Cadets have saved sufficient money to pay for their officers' uniforms and equipment by the time they graduate.

At the end of two years, if his record is clear, a cadet has a vacation, or "Furlough," for the summer, and may visit his home. The other summers during the course are spent in camp, where there are no lessons from books, but much drill, riding and practical work in engineering is done during the summer encampment.

Everything is done under strict military discipline. The superintendent is an army officer of high rank, and other officers are assigned to duty here. Cadets always wear uniform, and march to the door of the recitation room under charge of one of their number. In the room the instructor, usually an army officer, has charge. Sections are small, never more than fifteen and usually smaller. A student is called upon to recite nearly every day. No excuses are accepted for poor recitations, and marks are posted every week. A student is expected to spend about two hours in preparing his lesson in a hard subject, and if he fails in one of these subjects, he either is dropped from the Academy or is turned back to the next class, losing a whole year.

THE CADET'S MOTTO— DUTY, HONOR, COUNTRY

Misconduct of any sort is not permitted. If a young man is not respectful to his officers, is late, or does not keep his uniform, his gun or his room clean, he is punished by being given extra duty or by loss of privilege. If he is reported too often, he is suspended or dismissed. The West Point system and its character-building objective are best summed up in the motto of the United States Corps of Cadets—Duty, Honor, Country. A charming and interesting story of life at West Point before the Spanish-American War is Cadet Days, by Captain Charles King.

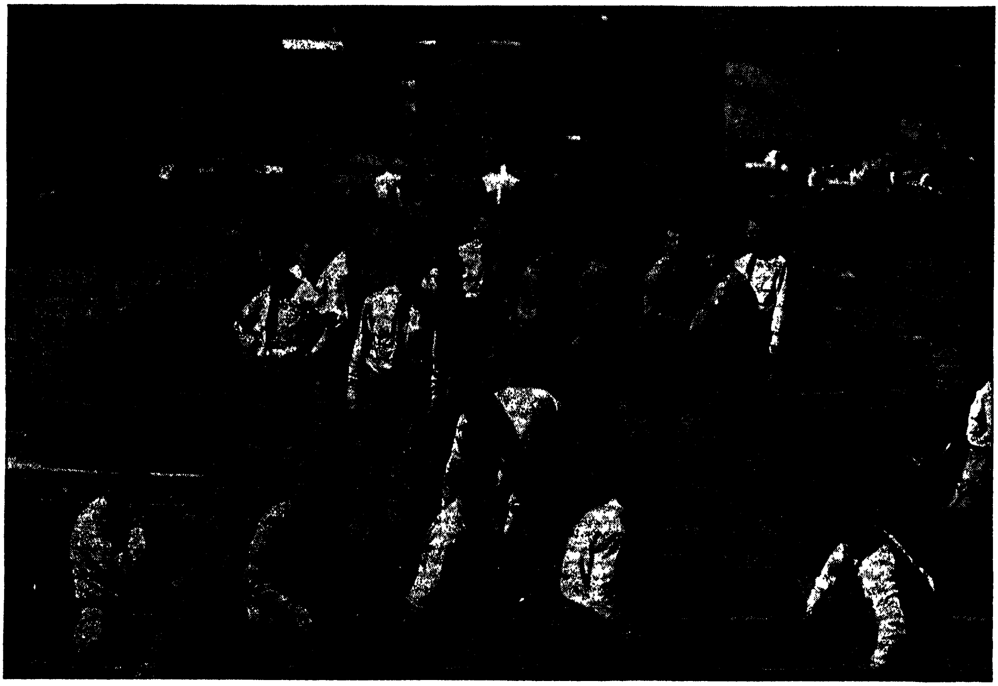
So the cadet's life goes on through the four years. He learns many things. The cadets do everything that the regular army men do, and they are commanded by cadet officers. These officers are much envied, as they are chosen from the cadets of highest standing. The cadet is taught that no man is fit to command who has not learned to obey. He is taught how to study, and he gains an almost perfect body.

THE GRADUATES WITH HIGHEST RECORDS GET PROMOTIONS FIRST

Then when he finally gets his diploma he is commissioned a second lieutenant in the United States Army, and begins his work as a leader of men. Those who have the highest record for studies and conduct are allowed to choose the branch of the service they prefer, as engineers, artillery, cavalry or infantry. The men of highest rank usually choose the engineers, but not always. Wher-

PRACTICE IN MODERN WARFARE

These cadets are examining a heavy field gun at West Point. Among the courses studied are mathematics, physics, engineering, gunnery and ordnance. Graduates receive the degree of Bachelor of Science.



There is plenty of hard work, for an Army officer must be equal to almost any emergency at home or abroad. These boys are learning how to build a pontoon bridge (a bridge that rests on boats).

ever they go their standing in class helps them, for the men of high rank are promoted first.

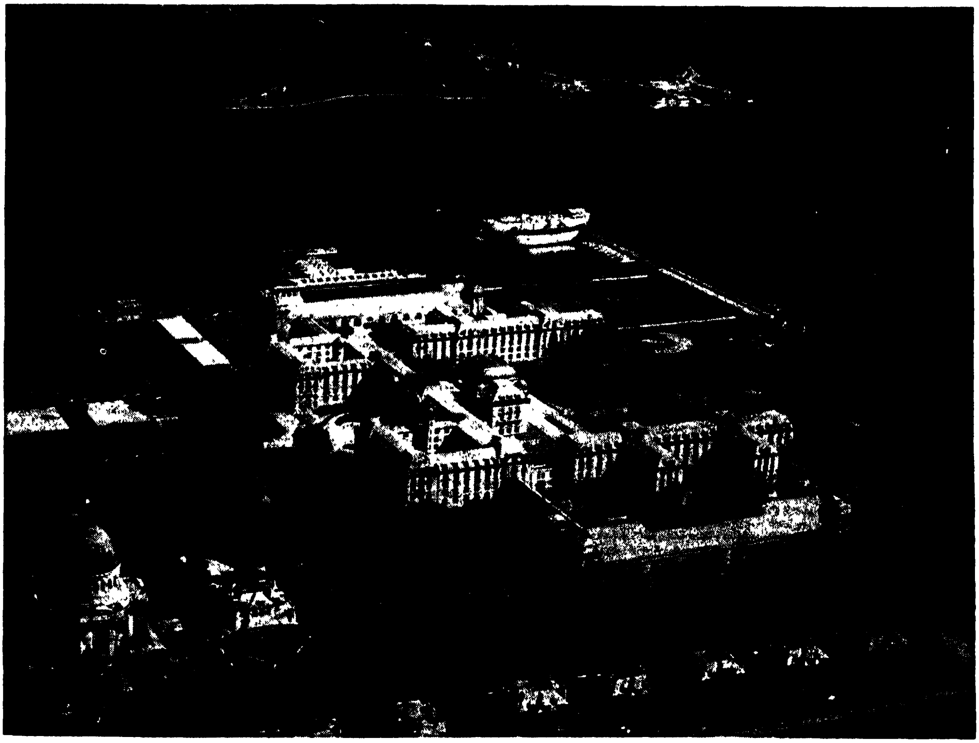
A hundred years ago boys who wished to become naval officers got appointments as midshipmen if they could, and were sent aboard one or another of the war vessels to carry messages for the officers. They were only boys, and no one looked after them very much unless they got into mischief. Then they were severely punished. Under these conditions a few became good sailors and officers, but the thoughtless did not learn much, and often formed bad habits.

Later several school masters were appointed to the ships, but sometimes the captains did not believe in the idea, and there were many interruptions to the teaching. Some of the officers favored a real naval school, and Matthew F. Maury, a distinguished officer, wrote so much upon the subject that he has been called the "Father of the Naval Academy." Finally the famous historian George Bancroft became Secretary of the Navy, and he determined to found a school to train officers.

Congress had not given any money for this purpose, but there was an abandoned fort at Annapolis, Maryland. The War Department turned over Fort Severn and nine acres of land to the Navy Department, and here in October, 1845, the Naval School was opened with three instructors and fifty midshipmen. The course of study was to be five years, of which the first and fifth were to be spent at school and the other three on board ship. The name was changed to the United States Naval Academy in 1850, and the time spent at school became four years. Soon the old Constitution was given as a training ship.

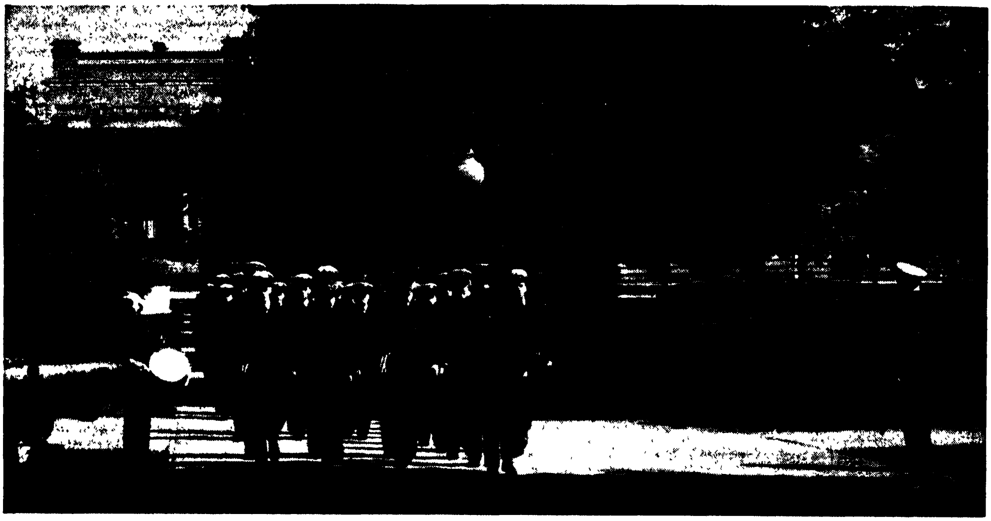
At the beginning of the Civil War it was feared that Annapolis was too far south to be safe from Confederate attack and the school was moved to Newport, Rhode Island, in 1861, and did not return to Annapolis until 1865.

After the Civil War the Navy of the



Official U. S. Navy Photograph

Bancroft Hall is an immense building in many wings. It is the midshipmen's dormitory. The building was named in honor of George Bancroft, the historian, who was Secretary of the Navy when the Academy was organized. On the grounds are a number of monuments and relics of historic interest, including a bell presented to Commodore Perry by the Japanese on his famous visit to Japan in 1853.



Midshipmen at Annapolis marching to recitation from their dormitory, Bancroft Hall. Annapolis is the most complete naval school in the world, and officers in our Navy are equal to any in the world.

United States was neglected, and little attention was paid to the Academy. There were not places in the Navy for all the graduates, and they were encouraged to resign. Later great interest was taken in the Navy, many new vessels were built, and more officers were needed.

Much land has been bought since 1865, and the grounds are quite extensive. Of the new buildings the largest is Bancroft Hall, where the midshipmen live. On one side is MacDonough Hall, the gymnasium, and on the other is Dahlgren Hall, the armory. East of the gymnasium is Luce Hall, the seamanship building. Behind Bancroft Hall is the Academic Group, consisting of Mahan Hall, Maury Hall and Sampson Hall, all named for distinguished Naval officers.

Under the law 5 midshipmen are allowed for each Senator, Representative, Delegate in Congress and the Vice-President; 5 from the District of Columbia; 5 from Puerto Rico; 4, one for each class, from the Philippine Republic; and one from the Canal Zone. Each year 25 may be appointed by the President; 100 from the Navy and Marine Corps; 100 from the Naval and Marine Corps Reserves; and 20 from certain military schools and Naval Reserve Officers Training Corps units. Also the President may appoint 40 from among sons of veterans of World Wars I and II who were killed in action or died as a result of active service; one native Puerto Rican. The number of midshipmen may be increased by presidential appointments from among sons of persons awarded the Congressional Medal of Honor; and 20 midshipmen may be appointed from other American republics, with not more than 3 from any one republic.

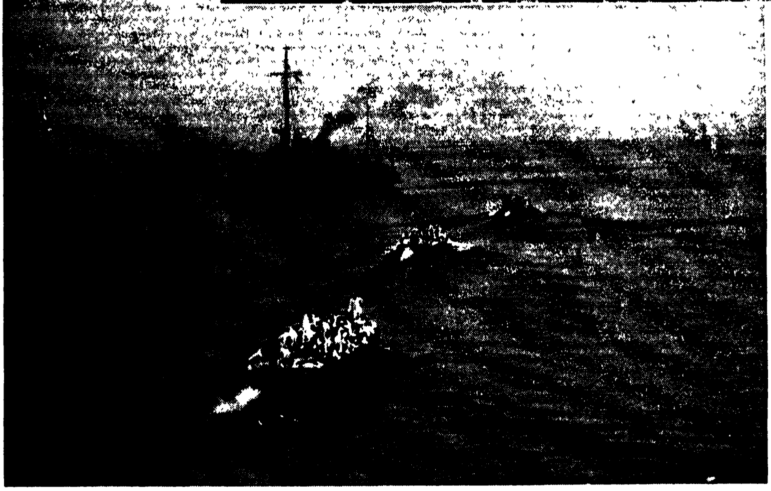
Entrance examinations are held at many places throughout the country. Certificates from some schools are accepted. If he passes the academic requirements, the candidate reports in Annapolis in June for his physical examination. This examination is even more strict than the one for West Point. If he is admitted he also becomes a "plebe," and the summer is spent in drill, gunnery, gymnastics and the use and management of boats.

Regular work begins in the fall. The course, like that at West Point, covers four years. It requires a great deal of several branches of mathematics, drawing, chemistry and physics, for a modern battleship is a complicated mass of machinery. The midshipman must also study English, history, Spanish and French. Some of the instructors are naval officers, others are civilians.

The discipline is much like that at West Point—very strict, but fair; and the midshipmen have a good time. They drill also, but their uniforms are blue, instead of gray as they are at West Point. Every summer the three upper classes go for three months on a practice cruise on warships, and then have a month's leave, during which they may visit their homes. As at West Point, the cadet is given pay which covers his expenses at the Academy during the four years.

OFF FOR A CRUISE

These midshipmen are embarking in tenders, to go off on a practice cruise. Midshipmen, in the summer of their first and third years, are sent on practice cruises of about three months' duration.



Official U. S. Navy Photographs

The tenders are approaching destroyers on which the practice cruise will be spent. The midshipmen learn practical details of life on board a fighting ship, and they make the acquaintance of some foreign ports.

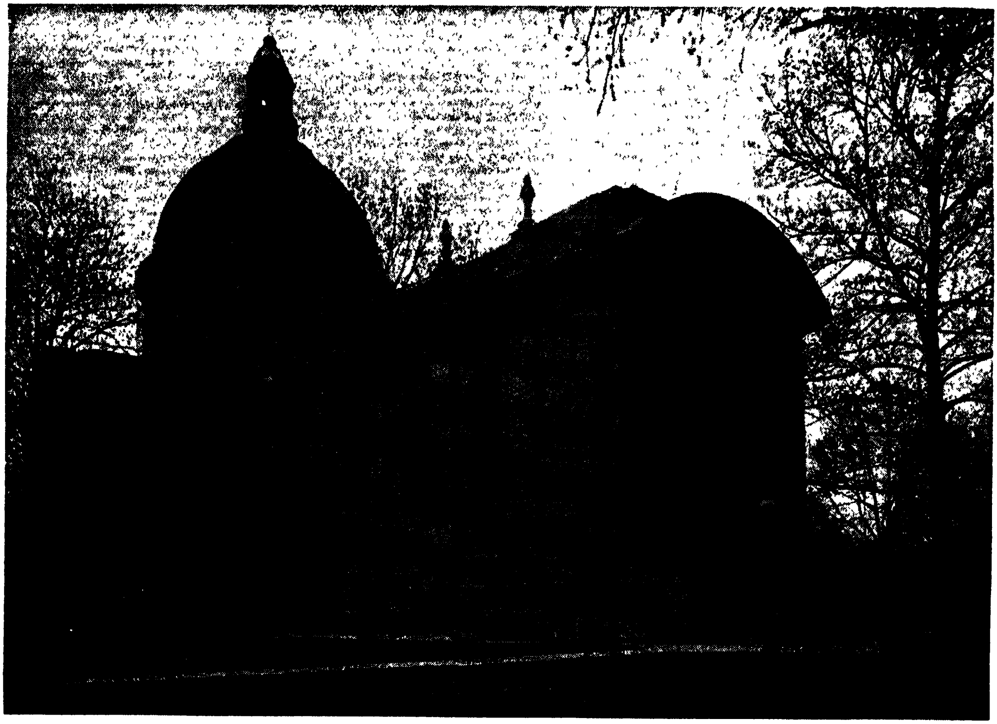
Much attention is given to athletics, particularly football; and both the academies have excellent teams. Both play with college teams, but the great game of the year is the one they play with each other. The Army-Navy game is attended by thousands of spectators. Very often the President, members of the Cabinet and other high officials of the government are present. Of course all the Army and Naval officers attend who can possibly do so.

When the midshipmen are graduated they are commissioned ensigns in the United States Navy or officers in the Marine Corps, and assigned to duty wherever they are needed. As in the Army, high rank at Annapolis helps to gain earlier promotion in the Navy, and the higher men may be lieutenants while the lower men are still serving as ensigns. However, high rank at graduation will not help an officer unless he continues to do well in his work.

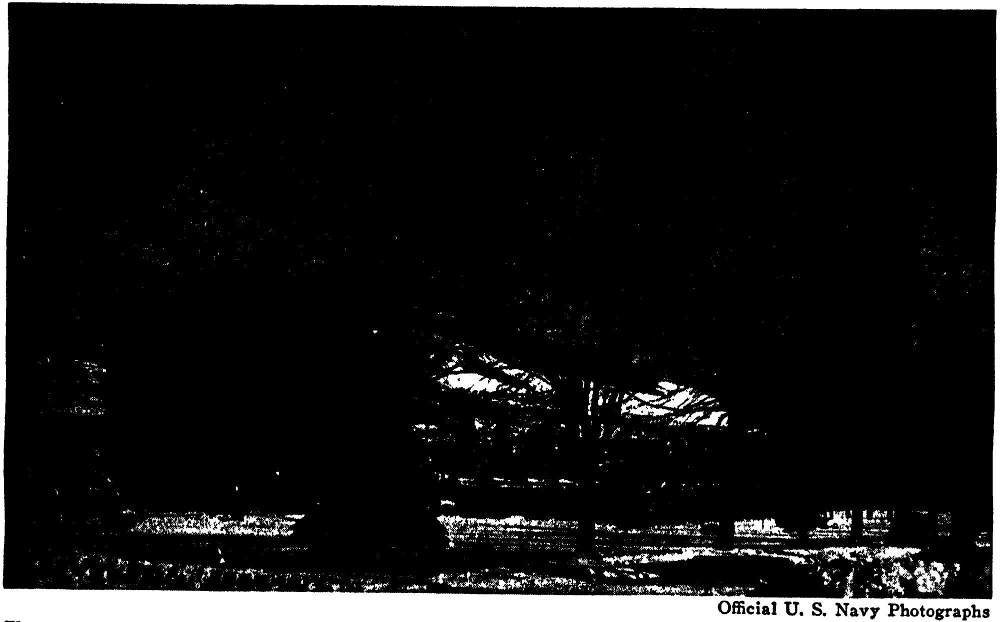
Such are the two great schools to train American officers. They are open to any American boy who can get an appointment, and generally the Members of Congress hold examinations and give the appointments to those who stand highest. When they enter the schools it does not matter whether their fathers are rich or poor, distinguished or unknown. Very often the cadets who stand the highest and are most liked come from humble surroundings.

THE NEXT STORY OF THE UNITED STATES IS ON PAGE 6825.

NEW CHAPEL AND ARMORY, ANNAPOLIS

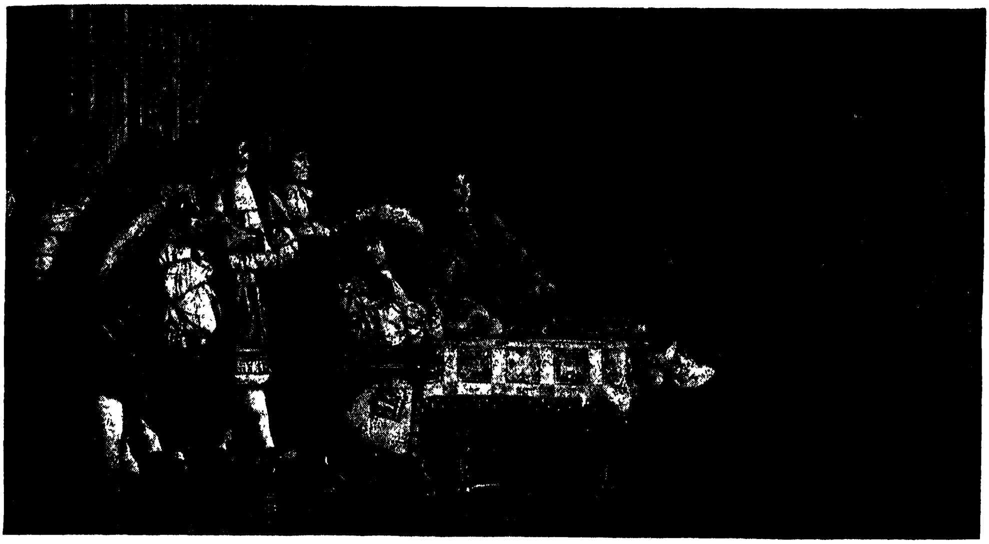


In the crypt of the impressive new chapel at Annapolis lies the body of John Paul Jones, famous naval hero of the Revolutionary War. This building is still known as the "new chapel," though it was built in 1908.



Official U. S. Navy Photographs

The armory, Dahlgren Hall, houses the Department of Ordnance and Gunnery. It was named for Rear Admiral John A. Dahlgren, one of the pioneers in the development of large-calibre naval guns. All midshipmen must study gunnery. The article on the United States Navy, page 6815, shows some modern fighting ships of various types.



From an old print

Louis XIV invites the actor-playwright Molière to breakfast.

THE LITERATURE OF FRANCE: II

PEACE and order were restored to France by the great King Henry IV toward the end of the sixteenth century. Literary disorder continued for some time; a number of poets still wrote as they pleased. The greatest of these apostles of liberty was Mathurin Régnier (1573-1613), whose fame rests on his outspoken Satires.

People were becoming tired, however, of these liberty-loving writers who were turning French literature into a sort of madhouse. Political order had been restored by Henry IV; order should be restored in literature as well. So thought the poet François Malherbe (1555-1628), who proceeded to lay down the law to French writers. Malherbe was the favorite poet of Henry IV and he retained his prestige after the King's death; he was in a position, therefore, to make his views respected.

Like the Pleiad poets, Malherbe was an admirer of Greek and Roman literature; he thought that French writers should know the ancients and follow them, too, but not so blindly as in the past. The chief guides for poets to follow should be reason and common sense. Malherbe proceeded to set up rules for French men of letters—rules for poetical usage and for versification. As a critic Malherbe exercised a great influence on French literature. As a poet he does not rank particularly high. His verses are clear and pleasing to the ear but almost entirely lacking in poetic fancy.

The first half of the seventeenth century was marked by a spirited battle over the literary rules set up by Malherbe and added to in the course of time by other conservative critics. The progress of the battle may be followed in the dramatic works of Pierre Corneille (1606-84). Corneille's first successful play, The Cid (1636), based on the exploits of a Spanish medieval hero, won great popular favor. However, it did not follow the rules established for dramatic poetry. Hence The Cid was condemned by the French Academy, a literary body backed by the powerful Cardinal Richelieu, minister of Louis XIV. Corneille bowed to the decision of the Academy; henceforth he obediently followed the rules.

His greatest plays, The Cid, Horace, Cinna, and Polyeucte, were all written in the first half of the century. They are marked by a keen dramatic sense and their language is often stirring. Corneille's later plays are quite inferior.

By the middle of the seventeenth century

From an old print

Molière always played the principal comic parts in his own plays. He left more than twenty comedies. Above is a scene from The Miser.

the supporters of law and order and the literary rules had won the day. Their creed was set forth in The Poetic Art of Nicolas Boileau (1636-1711). The doctrines of this work are in the main those of Malherbe, expanded somewhat here and there. Like Malherbe, Boileau exalts reason and common sense. He prescribes the authority of the ancients as literary guides. He gives the most detailed recipes for constructing all sorts of literary works—idylls, elegies, odes, sonnets, epigrams, epics and plays.

To many people who are not French, it seems amazing that a literature so restricted by rules could produce anything worth while. Yet the fact remains that the second half of the seventeenth century saw the production of a series of literary masterpieces. This was the Golden Age of French literature; even to-day the term French classicism is applied to the works of this period and to such other works as followed the same literary traditions.

It was an age when France dominated in almost every sphere. Her literature was admired and widely imitated; she was the foremost military power of Europe; the court of Louis XIV at Versailles was a model that other monarchs tried to follow.

THE PLAYS OF JEAN RACINE MARK THE HIGH POINT OF FRENCH DRAMA

In this period French drama reached perhaps its highest point in the plays of Jean Racine (1639-99). It is hard for Anglo-Saxons to understand and to appreciate such plays of Racine as Andromache, Britannicus, Iphigenia and Phædra. Racine was a court poet, a favorite of Louis XIV; that fact is evident in everything he writes. His characters, even the villains, have exquisite manners; their language is always in good taste. Yet once we get beneath the outer shell of politeness and refinement, we find a great dramatist who constructs his plays with the utmost skill and who has pierced the deepest secrets of the human heart.

Jean-Baptiste Poquelin (1622-73), an actor who took the stage name of Molière, was as outstanding in the field of comedy as Racine in tragedy. Molière's most important comedies are The Ridiculous Purists, Tartuffe, Don Juan, The Misanthrope and The Miser. Molière does what every successful writer of comedies must do; he makes us laugh. There is a universal note in his humor that makes it as unsurpassed to-day as it was in the seventeenth century. But Molière is not merely a great humorist; he is also a profound observer, who excels in exposing the follies of men—hypocrisy, intolerance, avarice, jealousy.

THE GAY FABLES IN VERSE OF JEAN DE LA FONTAINE

The contemporaries of happy-go-lucky Jean de la Fontaine (1621-95) dismissed him good-naturedly as an amiable good-for-nothing; yet he is considered one of the glories of French literature. His Fables, in verse, are known and admired the world over. These poems are taken from Æsop and other sources. In the hands of La Fontaine they emerge as little masterpieces, highly dramatic and wonderfully varied in mood and style. You will enjoy reading the two fables of La Fontaine that we give in the Book of Poetry.

French classicism produced other notable writers in the seventeenth century—Blaise Pascal (1623-62), who makes a profound study, in his Thoughts, of man's limitations and powers; François La Rochefoucauld (1613-80), whose Maxims are chiefly concerned with man's weaknesses; Jean La

Bruyère (1645-96), who satirizes contemporary figures in his witty Characters; the pious Bishop Bossuet (1627-1704), the author of eloquent sermons and eloquent, if biased, historical works; the kindly Archbishop Fénelon (1651-1715), who wrote several admirable works on education; Madame de Sévigné (1626-96), whose letters to her daughter give us intimate glimpses of a most picturesque age.

The traditions of French classicism were to prevail for many years to come. In the eighteenth century these traditions were firmly upheld in the schools and were followed quite generally by writers. Yet there were grumblings against this tyrannical authority as early as the Golden Age of French letters and they continued throughout the eighteenth century.

In the eighteenth century, too, there was

From an old print

Gustave Doré, a famous nineteenth century illustrator of books, gives us here a humorous and spirited picture of the miser who has lost his treasure, in La Fontaine's fable, The Miser.

a growing revolt against the established authorities in France; against what came to be called the *ancien régime,* the old system. The grandeur of the reign of Louis XIV had blinded men to the many injustices upon which it was based. To the upper classes were granted a multitude of privileges, while the burdens of the state fell upon those least able to support them—particularly the wretched peasants. After the constant wars of Louis XIV had brought France to the verge of ruin, these burdens on the lower classes became increasingly heavy. The feeling against the *ancien régime* grew more bitter in the course of the eighteenth century. At last the monarchy fell with a crash in the terrible days of the French Revolution, which began in 1789.

From an old print

Voltaire, the poet-philosopher, whose real name was François-Marie Arouet. He was a friend of the Prussian king, Frederick the Great.

French men of letters had an enormous share in bringing about the Revolution. The men who joined in the fight against the established authorities included most of the leading French writers of the eighteenth century. They were known as *philosophes* or philosophers. They drew much of their inspiration from the learned and skeptical Historical and Critical Dictionary of Pierre Bayle (1647-1706). They also owed much to the writings of such English thinkers as Locke, Shaftesbury and Bolingbroke.

The first prominent philosopher, and perhaps the greatest of all, was Voltaire, whose real name was François-Marie Arouet (1694-1778). Voltaire began his career as a poet. A period of exile in England—the result of a quarrel with a French noble—brought the poet in contact with English scientists and philosophers. Upon his return to France, Voltaire became a leader in the revolt against authority. He continued to write many purely literary works; he also wrote a series of burning treatises and pamphlets in which he denounced the abuses of the *ancien régime.*

SOME OF THE IMPORTANT PROSE WRITINGS OF THE GREAT VOLTAIRE

Voltaire's fame as a man of letters does not rest on his poetry, which is not of the first rank. He is remembered, among other things, for such tales as Candide, Micromégas and Zadig, which are not only extremely witty but very philosophical. His historical writings—The Century of Louis XIV, The History of Charles XII and the Essay on Customs—combine sound scholarship with an intelligent study of social background. His Correspondence is the richest and most revealing in French literature.

Another noted philosopher of the first half of the eighteenth century was the learned Baron de Montesquieu (1689-1755). In his masterpiece, The Spirit of the Laws, Montesquieu analyzes not only laws but also the various kinds of government. There are many more or less veiled attacks on the French monarchy; on the other hand Montesquieu praises to the skies the English government, where there is such a careful balance between legislative, executive and judicial powers. The Spirit of the Laws is sometimes confusing and even contradictory; yet it was one of the most influential works ever written.

THE ENCYCLOPEDIA THAT CAME OUT BOLDLY FOR PROGRESS AND DEMOCRACY

In the first half of the eighteenth century the attack on the *ancien régime* was carried on more or less under cover. In the second half of the century it became more outspoken. A leading factor in the attack was the Encyclopedia (1752-72). This learned work, in twenty-nine volumes, was the first great modern encyclopedia; it numbered among its contributors most of the leading French scientists and philosophers of the day. The Encyclopedia stood for reform—for liberty of commerce, for political liberty, for doing away with the special privileges of the upper classes. It had a deep faith in human progress and the future of society.

Voltaire was the leader of the philosophical group in the second half of the century until his death in 1778. Other philosophers included Denis Diderot (1713-84), the editor-in-chief of the Encyclopedia; the Count de Buffon (1707-88), the author of the famous Natural History; Etienne de Condillac (1715-80), whose Treatise on Sensations was one of the most important philosophical works of the century.

Voltaire's chief rival in the second half of the century was Jean-Jacques Rousseau (1712-78), a native of Geneva, Switzerland. Rousseau won renown as the author of two remarkable Discourses. In these treatises, one written in 1750 and the other in 1755, Rousseau denounced civilization. He claimed that the development of the arts and sciences had caused the corruption of mankind. He praised the goodness of nature and the men who lived according to the dictates of nature.

There is evidence that Rousseau himself did not take these ideas seriously at first. As time went on, however, he came to believe in them with all his heart and soul. He lived simply and according to what he considered the ways of nature; he insisted in his writings that we should follow nature as much as possible. We find this viewpoint in Emile, a treatise on education; we find it in the tearful novel The Modern Héloïse, in which the characters follow the promptings of their hearts and not the dictates of reason.

From an old print

Jean-Jacques Rousseau, who said that our modern civilization had developed mankind along lines that were wrong because they were against nature.

ROUSSEAU DEFINED GOVERNMENT AS A CONTRACT BETWEEN RULERS AND PEOPLE

We find it also in The Social Contract, perhaps his most influential work. In it Rousseau defines government as a simple contract drawn up between the ruler and his subjects when man was in a primitive, hence natural, state. When the ruler becomes oppressive, he breaks the terms of the contract and the people have the right to depose him. Robespierre and other leaders of the French Revolution applied this idea in overturning the French monarchy.

The fight against the *ancien régime* absorbed the energies of the greatest men of letters in the eighteenth century. Apart from the works in which that fight was carried on, French literature produced little that was first-rate. There was practically no great poetry. The tragedies written in the classical tradition were feeble; those which attempted to break with tradition were no better. The outstanding dramatic works of the century were two comedies by the adventurer Pierre Augustin Caron de Beaumarchais (1732-99)—The Barber of Seville and The Marriage of Figaro. Both plays have bright stories, full of wit and high spirits. They also contain sharp comments on the life of the day under a thin veil of humor.

MANON LESCAUT, ONE OF THE GREATEST LOVE STORIES EVER WRITTEN

In fiction the eighteenth century has only a few works that rise above the general level of mediocrity. The greatest novel of the century is Manon Lescaut (1761), by the Abbé Prévost. It is the story of the undying love of the Chevalier Des Grieux for the girl Manon. The work is quite short; its style is simple and unpretentious. Yet it is one of the most touching love stories ever written.

In 1789 the storm that was gathering about the *ancien régime* broke at last. The period from 1789 to 1815, when the French monarchy was definitely restored, is one of the stormiest in French history. It witnessed not only the excesses of the French Revolution but also the rise and fall of the great Napoleon Bonaparte (see page 2198).

MADAME DE STAËL WHO DENOUNCED THE OLD CLASSICAL RULES

During this time, men continued to write numberless volumes—political pamphlets, poems, dramas, novels; but there was little that was worth while. Two names stand out above all the rest. Madame de Staël (1766-1817), a disciple of Rousseau, wrote two woeful novels—Delphine and Corinne—and several sound works of literary criticism in which she denounced the old classical rules. Her full name was Anne Louise Germaine Necker de Staël-Holstein.

THE ROMANTIC REVIVAL OF ART AND LITERATURE

The aristocratic François René de Chateaubriand (1768-1848) was the author of the melancholy novels Atala, René and The Natchez, which have an American, or rather, American Indian, background. Chateaubriand also wrote The Genius of Christianity, a treatise in which he urged Christian writers to use Christian models. The Martyrs, a long prose epic, was a not very successful effort to put his theories into practice. Chateaubriand's pompous Memoirs From Beyond the Grave appeared after his death.

Near the end of the eighteenth century Europe began to be swept by Romanticism —a revolt against the artificial elements of eighteenth century culture. This movement made itself felt in literature as well as in art and music. To a certain extent Rousseau, Madame de Staël and Chateaubriand participated in the Romantic revival. It did not attain its full development in France, however, until the twenties of the nineteenth century.

French Romanticism protested against the traditional literary rules. It demanded that reason in literature should be replaced by imagination and emotion; that the author should be free to expose the innermost secrets of his heart. It exalted the individual; particularly the individual who revolts against someone or something.

VICTOR HUGO, POET AND NOVELIST OF THE ROMANTIC SCHOOL

The leading figure of French Romanticism was Victor Hugo (1802-85). Hugo was perhaps the greatest of all French lyric poets, though he was also renowned as a novelist and dramatist. The lyrics of Hugo combine glowing imagination with supreme mastery of versification. His finest poetical work, The Legend of the Centuries, was written in the autumn of his life (1859-83). The poems of this collection are in the form of little epics that set forth the lives of heroes of legend and of history. The Legend of the Centuries is grand in conception and written in magnificent verse.

Hugo's novels, which include such universal favorites as Notre Dame de Paris, Les Misérables and Ninety-three, are marked by great narrative skill. Hugo's plays, such as Le Roi S'amuse (The King Amuses Himself), Hernani and Ruy Blas, contain much brilliant verse and not a few highly dramatic episodes. The situations are often quite improbable, however, and the fine speeches of Hugo's dashing heroes sometimes become boring.

Victor Hugo, author of the powerful story Les Misérables, part of which we give you in Volume 11.

Of the other Romanticists, Alphonse de Lamartine (1790-1869) is famed for the melancholy simplicity of his verse. The poetry of Alfred de Vigny (1797-1863) reveals a proud and pessimistic nature. Few poets have disclosed more of their innermost thoughts than Alfred de Musset (1810-57). Saddened by an unfortunate love affair, he told of his sorrow in some of the most beautiful poems in French literature —Souvenir and the four poems known as Nights.

Alexandre Dumas the Elder (1803-70) wrote some very violent plays—Henry III, Antony, The Tower of Nesles. He is better known to English readers for his novels, particularly The Three Musketeers and The Count of Monte Cristo.

Certain writers who lived in the Romantic period were not greatly affected by the literary currents of the time. The great novelist Honoré de Balzac (1799-1850) has left us some fascinating studies of the civilization that the Romantics found dull and prosaic. After writing some outstanding novels, Balzac conceived the plan of The Human Comedy, a cycle or group of novels that would give a record of his own times. Though The Human Comedy was never completed, many of the novels in the cycle were published, including Le Pere Goriot (Father Goriot), César Birotteau and Le Cousin Pons. Balzac creates atmosphere by marvelously exact description. He is a profound student of human nature and he has created a number of immortal characters.

Marie-Henri Beyle, who wrote under the pen name of Stendhal (no first name), lived from 1783 to 1842. He wrote novels and criticism.

THE NOVELS OF STENDHAL WHICH WERE NEGLECTED IN THE AUTHOR'S LIFETIME

When you read the Romantic novels of the day, you see the action from far off, as if it takes place on a stage. Stendhal carries the reader close to what is happening, even into the hearts and minds of his characters. He sets down their innermost thoughts clearly and coldly. The Red and the Black, and The Charterhouse of Parma, by him, are among the most famous novels in French, and have a place among the great literary works of the world. Neglected in Stendhal's own day, these works came into their own after his death.

Certain Romanticists turned their backs on the movement after a time. Théophile Gautier (1811-72) and Charles Augustin Sainte-Beuve (1804-69) were violent supporters of Romanticism in their youth. In later life, however, Gautier wrote poems that were anything but romantic. This is particularly true of the flawless and impersonal lyrics of Enamels and Cameos (1856), Gautier's masterpiece. As for Sainte-Beuve, he became a conservative critic—one of the greatest who ever lived. In his immortal Monday Chats and New Monday Chats he maintains that there is much that is fine in all literature—classical as well as Romantic.

There is a decidedly Romantic note in the earlier novels—Valentine, Lélia, Jacques—of the greatest woman writer in French literature—Lucile Aurore Dupin, who took the pen name of George Sand (1804-76). Her later works show a calmer spirit; they include such charming idylls of country life as The Devil's Pool and Little Fadette. She was a very fertile writer.

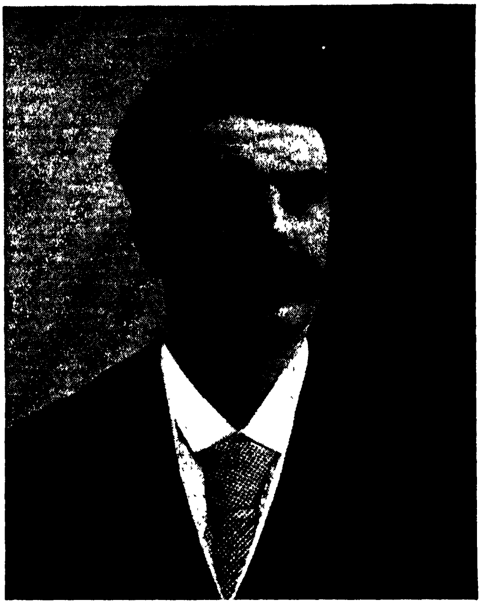
By the year 1850 Romanticism had run its course. A new spirit was in the air, a scientific spirit that demanded careful observation and that suppressed emotion. The era of realism in French literature was at hand.

The novel at this time was the most important form in French literature—a position it has retained to the present day. It discarded the exaggerations of Romanticism and tried to present a faithful, detailed account of life as it is actually lived. This spirit of realism is to be found in the works of Gustave Flaubert (1821-80), one of the most painstaking writers of all time. His masterpiece, Madame Bovary, is a revealing story of the effect of the Romantic spirit upon a weak woman. A great amount of reading and study went into the preperation of Flaubert's Salammbô, a tale of ancient Carthage. No historical novel has ever had a more authentic background; but this background is presented in such detail that it overshadows the story itself.

Flaubert's impersonal attitude toward life was adopted by his favorite disciple, Guy de Maupassant (1850-93). Though Maupassant wrote six novels, his fame rests

The Bettmann Archive

The Three Musketeers, by Alexandre Dumas the Elder, is an exciting story about D'Artagnan, a soldier of fortune, and his three boon companions. In this scene D'Artagnan (right) fights a duel.



P. Nadar, Paris

Guy de Maupassant, whose short stories are studied to-day as models of skillful construction.

chiefly on his short stories, which are among the best ever written. The author is a keen observer and his tales are models of skillful construction. Yet they are sometimes unpleasant reading, for they seem to display indifference to human suffering. This is shown strikingly in the story called The Diamond Necklace, given on page 3683.

Though Alphonse Daudet (1840-97) adopts the realistic approach in most of his novels, especially The Nabob, Jack and Sapho, his sparkling humor and above all his deep sympathy for suffering mankind set him apart from many other realistic authors. This pity is well illustrated in the story called The Last Class.

In 1880 the novelist, Emile Zola (1840-1902) announced the formation of a new literary movement—naturalism. This was really realism in an exaggerated form. It proposed to set forth in endless detail many phases of life that had hitherto been ignored by most novelists; it aimed to be scientific. Zola's claim to have discovered naturalism was disputed by Edmond de Goncourt (1822-96), who pointed out that his brother Jules (1830-70) and he had written a novel that answered to Zola's definition as early as 1865. This work was Germinie Lacerteux, the story of a servant girl's life. Literary critics are divided as to the justice of Edmond de Goncourt's claim.

Zola applied his theories in the twenty long novels that trace the history of the Rougon-Macquart family. In spite of their pretensions, these works are too violently one-sided to be scientific. Some of his novels, however—particularly The Slaughterhouse, The Disaster, and Germinal—are powerfully written. Other naturalist writers included Paul Adam (1862-1920) and the Margueritte brothers, Paul (1860-1918) and Victor (1866-1942).

POETS OF THE REALISTIC SCHOOL AND BAUDELAIRE, THE ROMANTIC

The poetry of the realistic age shows the effects of the spirit of keen observation and disciplined expression. These qualities mark the poetry of Charles Leconte de Lisle (1818-94). His Barbaric Poems and Tragic Poems contain magnificent word-pictures, but there is no trace of a personal note. Similar qualities are to be found in The Trophies, a poetical collection by Leconte de Lisle's favorite pupil, the Cuban, José-Maria de Hérédia (1842-1905). In one poet, however, the spirit of individualism is as strong as ever. The wild poetry of Charles Pierre Baudelaire (1821-67), particularly his The Flowers of Evil, might well have been written in the early days of Romanticism.

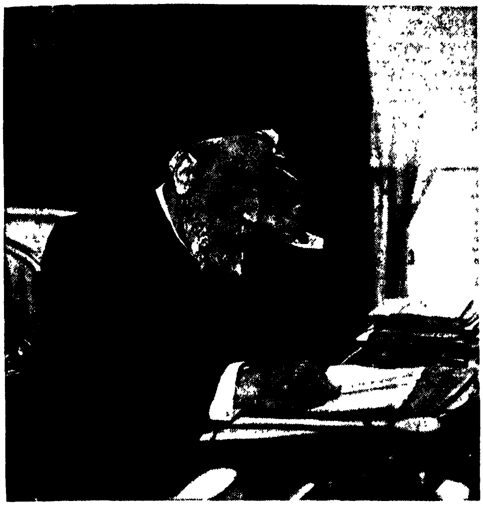
The realistic drama aims to give a faithful picture of life. Alexandre Dumas the Younger (1824-95), son of the author of The Three Musketeers, discusses social problems in such thoughtful plays as The Lady With the Camelias (better known to English readers as Camille), The Question of Money and Denise.

As time went on, even the ugliest aspects of life were shown on the stage, particularly in the gloomy plays of the Free Theatre, a radical dramatic group.

In the eighties there was a strong reaction against the scientific spirit in literature —against the impersonal sort of writing in which the author becomes a mere recorder of what he has observed. As a matter of fact, people had begun to lose their unquestioning faith in science. Many turned from its stern discipline to mysticism and—incredible though it may seem—to black magic, a form of witchcraft.

JORIS KARL HUYSMANS, PAUL BOURGET AND PIERRE LOTI (JULIEN VIAUD)

The novel now shows different trends. Joris Karl Huysmans (1848-1907) began his literary career with several labored naturalistic novels. He then turned to what cer-



Kadel and Herbert News Photo

Anatole France (Jacques-Anatole Thibault) enjoyed enormous success in his own lifetime.

tain critics call mysticism and what others call, perhaps more accurately, the search for new sensations. In Huysmans' curious novel Against the Grain, the hero constantly seeks new thrills. He finds them in perfumes, in jewelry, in grotesque paintings and in Medieval Latin.

Following in the footsteps of Stendhal, Paul Bourget (1852-1935) developed the psychological novel, in which a minute study is made of the inner life of the characters. His best works are Cruel Enigma, André Cornelis and The Disciple.

The author's personal impressions, thinly disguised, are to be found in the works of the naval officer Julien Viaud (1850-1923), whose pen name was Pierre Loti. His best works—The Novel of a Spahi, My Brother Yves and Iceland Fisherman—are marked by a strong note of melancholy.

The personal element is also present in the novels of Anatole France (1844-1924), who was born Jacques Anatole Thibault. With him the novel is generally a convenient medium for displaying the sparkling wit, the mocking scepticism and the great learning of the author. There are few more delightful works in French literature than At the Sign of the Queen Pédauque and Penguin Island. The Crime of Sylvestre Bonnard was his first novel. It is a tender, moving story which Lafcadio Hearn translated into English. Anatole France won the Nobel Prize in 1921. France was a renowned critic as well as novelist.

In poetry the revolt against the flawless and cold poetry of Leconte de Lisle and his followers was led by the group of poets called Symbolists. They replaced sharp outlines with shadowy images; they sought to produce a poetic effect by the sheer music of their verse. The leading symbolist poet, Paul Verlaine (1844-96), was quite successful in his efforts to suggest a mood rather than to paint a picture in verse.

MALLARMÉ, THE POET FEW PEOPLE CAN UNDERSTAND

On the other hand, the learned professor-poet, Stéphane Mallarmé (1842-98), suggested so many things in his obscure verses (which include the famous Afternoon of a Faun) that even his faithful admirers disagreed in their interpretation of the master's works. There was no obscurity in the glowing verses of the Belgian poet, Emile Verhaeren (1855-1916), who belonged to no literary school. He excelled in describing modern life with its huge cities, its vast multitudes of people and its greedy industries.

In the drama, the shocking realism of the Free Theatre was soon discredited. There was a return to the problem play of Dumas the Younger in the thoughtful dramas of Eugène Brieux (1858-1932). He discussed on the stage such matters as gambling, motherhood, education and medicine. His masterpiece, The Red Robe, is a bitter attack against the legal profession.

The plays of Edmond Rostand (1868-1918) are far removed from the sad realities of life; they are full of dare-devil exploits and eloquent speeches. His masterpiece is Cyrano de Bergerac, a vivid drama with a seventeenth century author and duelist as its hero. Rostand struck a different note in his symbolical play Chanticleer, in which the characters are barnyard animals.

THE BELGIAN, MAURICE MAETERLINCK, WHO WROTE THE BLUE BIRD

The mystic note is present in the striking plays of the Belgian, Maurice Maeterlinck (1862-1949). Most of his stories are allegories. The Blue Bird, for instance, is an allegory of the search for happiness.

There was no sharp break between the nineteenth century and the twentieth; some of the men we have just discussed wrote outstanding works in the present century. The confused literary currents of the last years of the nineteenth century were carried over into the twentieth. It was felt at one time, indeed, that World War I (1914-18) might bring about a new period of stability, based on idealism and patriotic devotion. This did not come to pass. The grim struggle produced some fine war novels, such as The Wooden Crosses, by Roland Dorgelès, Under Fire, by Henri Barbusse, The Life of the Martyrs, by Georges Duhamel and The Dream, by Henri de Montherlant; but otherwise it had no permanent effect on French literature, which continued to rest on an ever shifting foundation. We are reminded of what the philosopher Henri Bergson (1859-1941) said—that our ideas should be "as plastic and as fluid as we are ourselves."

THE NOVELS OF MARCEL PROUST, WHO WORKED IN A SOUND-PROOF CHAMBER

The most original novelist of the twentieth century was Marcel Proust (1871-1922). A hopeless invalid, he shut himself up in a sound-proof chamber and wrote long novels in a cycle called Remembrance of Things Past. He begins by focusing his attention upon some apparently insignificant memory of the past. One memory leads to another and in this way the author builds up the recollection of the past that he sets forth in his novels. The hop-skip-and-jump methods of the author make Remembrance of Things Past very difficult reading; but those who read all the volumes of the cycle are amply rewarded, for Proust is a great writer.

Other novel-cycles were produced in the course of the century. Jean-Christophe, by Romain Rolland (1866-1944) offers us in its many volumes a fascinating study of contemporary French society, seen through the eyes of a German musician. The collection of novels known as The Thibaults, by Roger Martin du Gard (1881-), tells of a representative French family. Not merely a single family but almost every aspect of modern French civilization is considered in the great novel-cycle of Men of Good Will, by Jules Romains (1885-), whose real name is Louis Farigole.

SOME OTHER NOVELISTS OF MODERN TIMES

The compassionate works of Georges Duhamel (1884-) show a profound insight into human lives. There is not much compassion in the novels of André Gide. He is an anarchist in works like The Counterfeiters and The Cellars of the Vatican; in his later works he turns to communism. Charm and imaginative power mark the works of Madame Gabrielle Colette (1873-). There is also charm of a very melancholy sort in Maria Chapdelaine, a story of Canadian life by Louis Hémon (1880-1913), who lived in Canada for a time.

ANDRÉ MAUROIS, WHO STARTED A NEW FASHION IN BIOGRAPHIES

André Maurois (1885-), whose real name is Emile Hertzog, discusses the follies of modern civilization in his novels and short stories. In 1923 he started a new literary fashion with the delightful Ariel, a biography in the form of a novel, about the English poet Shelley.

The poetry of the present century shows a most bewildering variety. The stirring French Ballads of Paul Fort (1872-), which are full of quaint archaic forms, go back to the glorious past of France for inspiration. Charles Péguy (1873-1914), an ardent mystic, stresses the "greatness and wretchedness of man and his need of salvation."

On the other hand, the Countess de Noailles (1876-1933) writes like a pagan Greek; she is a seeker of earthly beauty. Paul Valéry (1871-1945), a disciple of Mallarmé, the symbolist poet, wrote verses even more obscure than those of his master. Antoine de Saint-Exupéry (1900-44) was an aviator who lost his life in World War II. Three of his books, Wind, Sand and Stars; Night Flight; and The Little Prince, are well known in English translation.

THE PLAYWRIGHTS: BERNSTEIN, BATAILLE, CLAUDEL AND GUITRY

Drama shows the same variety. There is exciting melodrama in such early plays of Henri Bernstein (1876-) as The Squall and The Thief. In his later plays, which include Judith and The Mirror Gallery, action is reduced to the minimum and the dramatist devotes himself to the study of character.

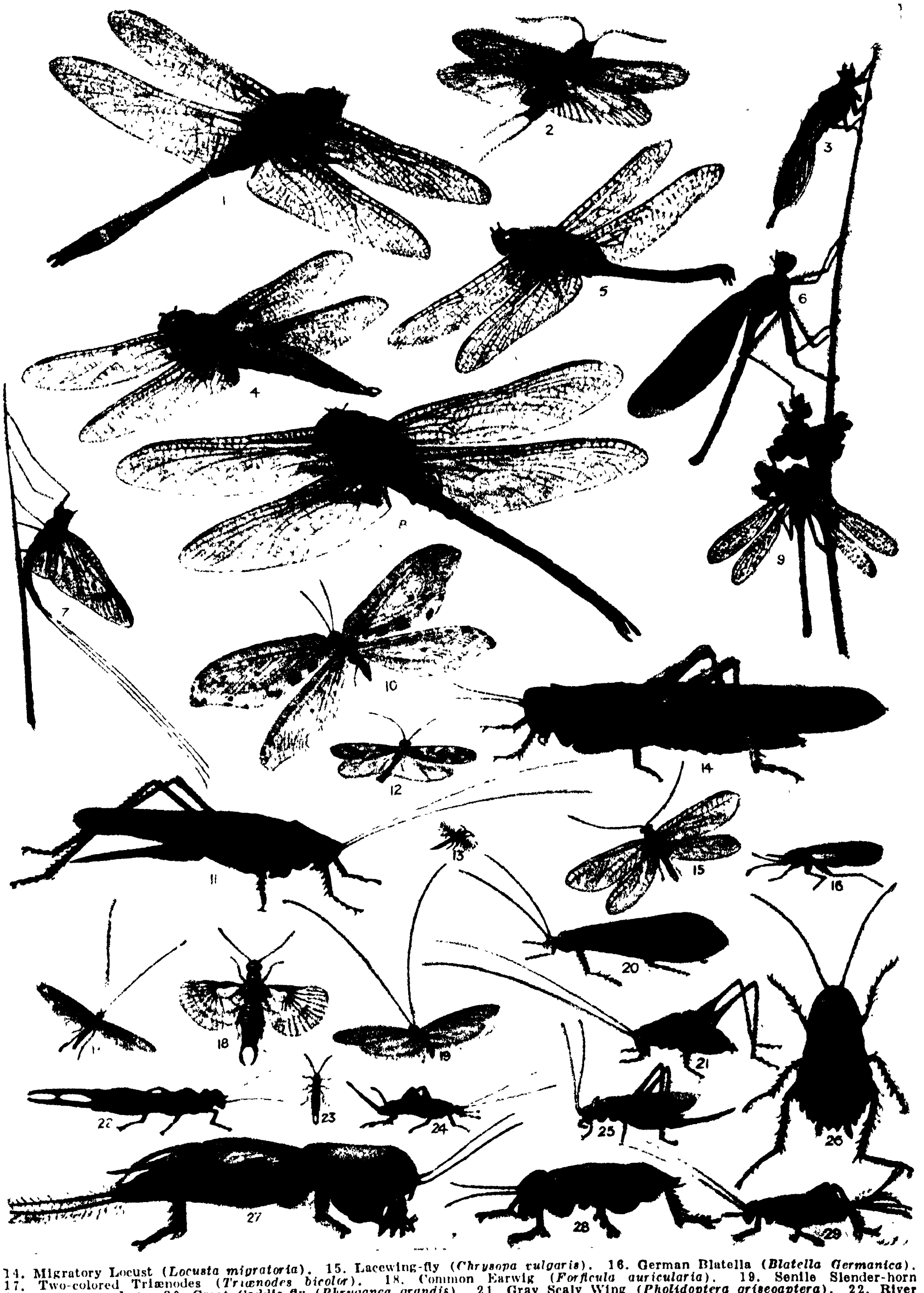
Henri Bataille (1872-1922) sees life as a conflict between love and duty; love is almost always triumphant in his plays. There is a strong religious note in the plays of Paul Claudel (1868-), whose masterpiece is The Annunciation. The plays of Sacha Guitry (1885-)—Mozart, Deburau, Pasteur and others—are extremely witty but not very profound.

Jean-Paul Sartre (1905-) has been the center of a circle of writers called the Existentialists. They believe that man lives, or exists, only through his relations with others. Albert Camus (1913-) became famous in 1947 for The Plague, a masterly novel.

THE NEXT STORY OF LITERATURE IS ON PAGE 6904.

SOME OF NATURE'S INSECT CHILDREN

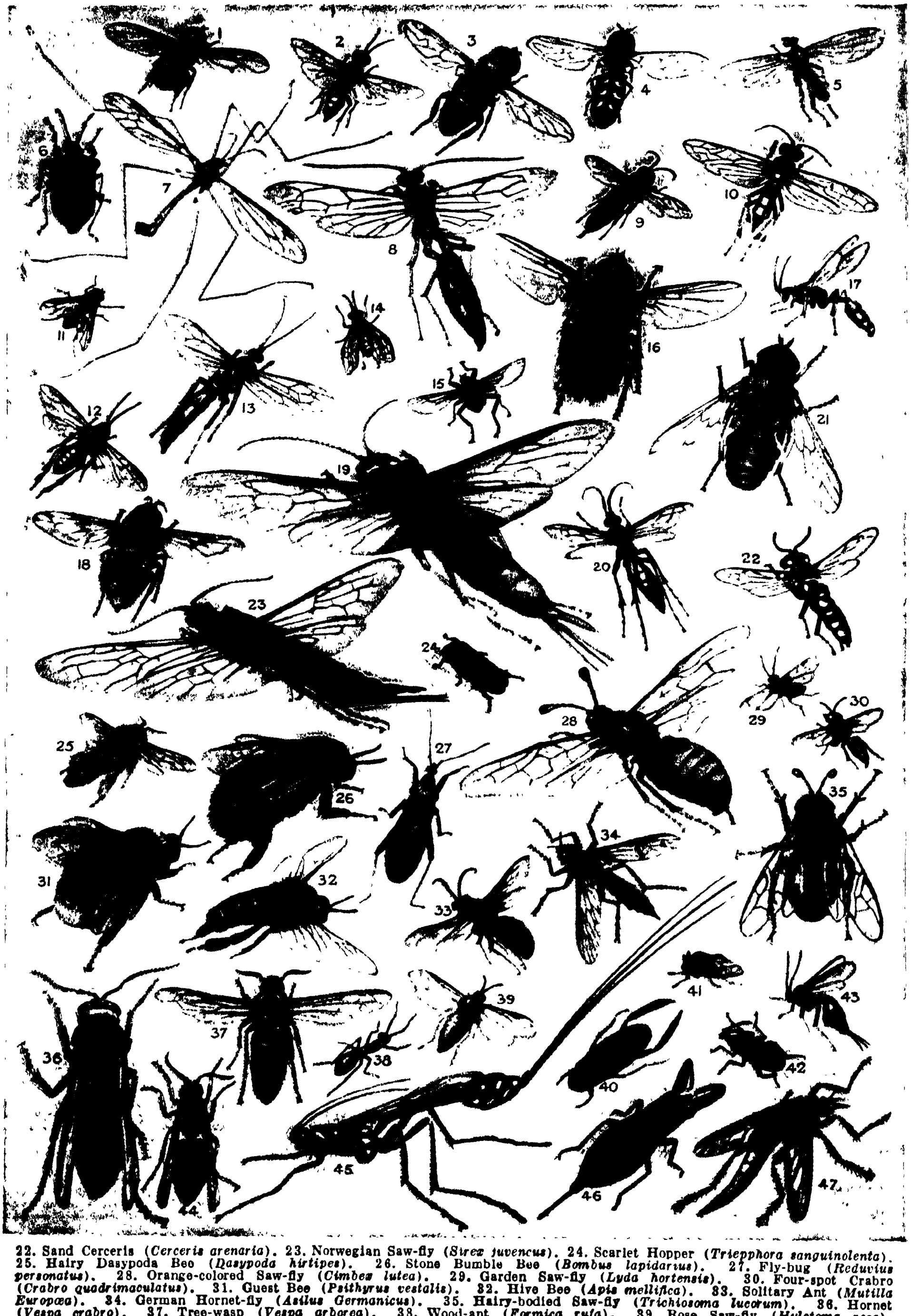
1. **Ringed Club Dragon-fly** (*Cordulegaster annulatus*). 2. Giant Stone fly (*Perla maxima*). 3. Red Nymph Dragon-fly (*Pyrrhosoma nymphula*). 4. Flat Book Dragon-fly (*Libellula depressa*). 5 Bronze Club Dragon fly (*Cordulia ænea*). 6. Beautiful Maiden Dragon-fly (*Calopteryx virgo*). 7. Common May-fly (*Ephemera vulgata*). 8. Giant Dragon-fly (*Æschna grandis*). 9. Robber Dragon-fly (*Lestes sponsa*). 10. Golden Osmylus (*Osmylus chrysops*). 11. Great Green Grasshopper (*Tettigonia viridissima*). 12. Small Caddis-fly (*Phryganea minor*). 13. Leathery thrips (*Phlæothrips coriacea*).



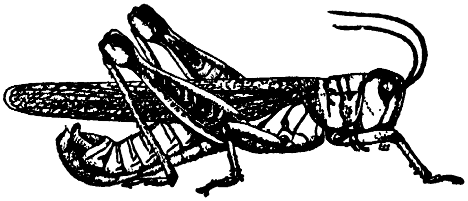
14. Migratory Locust (*Locusta migratoria*). 15. Lacewing-fly (*Chrysopa vulgaris*). 16. German Blatella (*Blatella Germanica*). 17. Two-colored Triænodes (*Triænodes bicolor*). 18. Common Earwig (*Forficula auricularia*). 19. Senile Slender-horn (*Leptocerus senilis*). 20. Great Caddis-fly (*Phryganea grandis*). 21. Gray Scaly Wing (*Pholidoptera griseoaptera*). 22. River Earwig (*Labidura riparia*). 23. Little Eerwig (*Labia minor*). 24. Wood Nemobius (*Nemobius sylvestris*). 25. Sea-green Grasshopper (*Meconema thalassinum*). 26. Domestic Cockroach (*Blatta orientalis*). 27. Mole Cricket (*Gryllotalpa vulgaris*). 28. Field Cricket (*Gryllus campestris*). 29. House Cricket (*Gryllus domesticus*).

DRAGON-FLIES, BEES, ANTS AND FLIES

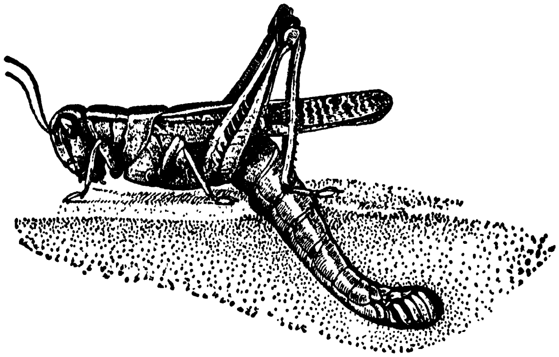
1. Meat-fly (*Musca lardaria*). 2. Ox-eyed Astata (*Astata boöps*). 3. Drone-fly (*Eristalis tenax*). 4. Fiery-starred Syrphus (*Syrphus Pyrastri*). 5. Cow-dung Fly (*Scatophaga scybalaria*). 6. Pale Bishop's-mitre (*Asopus luridus*). 7. Crane-fly (*Tipula longicornis*). 8. Trogos Ichneumon Fly (*Trogos atropos*). 9. Fiery Ruby-tailed Fly (*Chrysis ignita*). 10. Girdled Tenthredo (*Tenthredo zonatus*). 11. House-fly (*Musca domestica*). 12. Crœsus Saw-fly (*Crœsus septentrionalis*). 13. Solid Ichneumon Fly (*Ichneumon crassorius*). 14. Turnip Saw-fly (*Athalia spinarum*). 15. Horse-fly (*Hippobosca equina*). 16. Broad Tachina (*Tachina grossa*). 17. Field Mellinus (*Mellinus arvensis*). 18. Feathered Volucella (*Volucella plumata*). 19. Giant-tailed Wasp (*Sirex gigas*). 20. Tawny Digger (*Pompilus fuscus*). 21. Great Gadfly, or Cleg (*Tabanus bovinus*).



22. Sand Cerceris (*Cerceris arenaria*). 23. Norwegian Saw-fly (*Sirex juvencus*). 24. Scarlet Hopper (*Triepphora sanguinolenta*). 25. Hairy Dasypoda Bee (*Dasypoda hirtipes*). 26. Stone Bumble Bee (*Bombus lapidarius*). 27. Fly-bug (*Reduvius personatus*). 28. Orange-colored Saw-fly (*Cimbex lutea*). 29. Garden Saw-fly (*Lyda hortensis*). 30. Four-spot Crabro (*Crabro quadrimaculatus*). 31. Guest Bee (*Psithyrus vestalis*). 32. Hive Bee (*Apis mellifica*). 33. Solitary Ant (*Mutilla Europæa*). 34. German Hornet-fly (*Asilus Germanicus*). 35. Hairy-bodied Saw-fly (*Trichiosoma lucorum*). 36. Hornet (*Vespa crabro*). 37. Tree-wasp (*Vespa arborea*). 38. Wood-ant (*Formica rufa*). 39. Rose Saw-fly (*Hylotoma rosa*). 40. Water-boatman (*Corixa Geoffroyi*). 41. Eared Hopper (*Centrotus cornutus*). 42. Scarlet Bug (*Pyrrhocoris apterus*). 43. Ichneumon Migrator (*Spilocryptus migrator*). 44. Common Wasp (*Vespa vulgaris*). 45. Rhyssa Ichneumon Fly (*Rhyssa persuasoria*). 46. Water-scorpion (*Nepa cinerea*). 47. Great Hornet-fly (*Asilus crabroniformis*).



The grasshopper, an insect famed in legend from the earliest days. It is a greedy creature, delighting in green plants. As you see, its hind legs are powerfully developed and enable the insect to jump almost unbelievable distances.



A female grasshopper laying its eggs. In the fall it drills a hole in the ground with an organ called the ovipositor and then lays its eggs in the hole. As in the other picture, the insect is shown here a little larger than natural size.

Both photos, courtesy, U.S. Dep't of Agriculture

GRASSHOPPERS AND SOME OTHER INSECTS

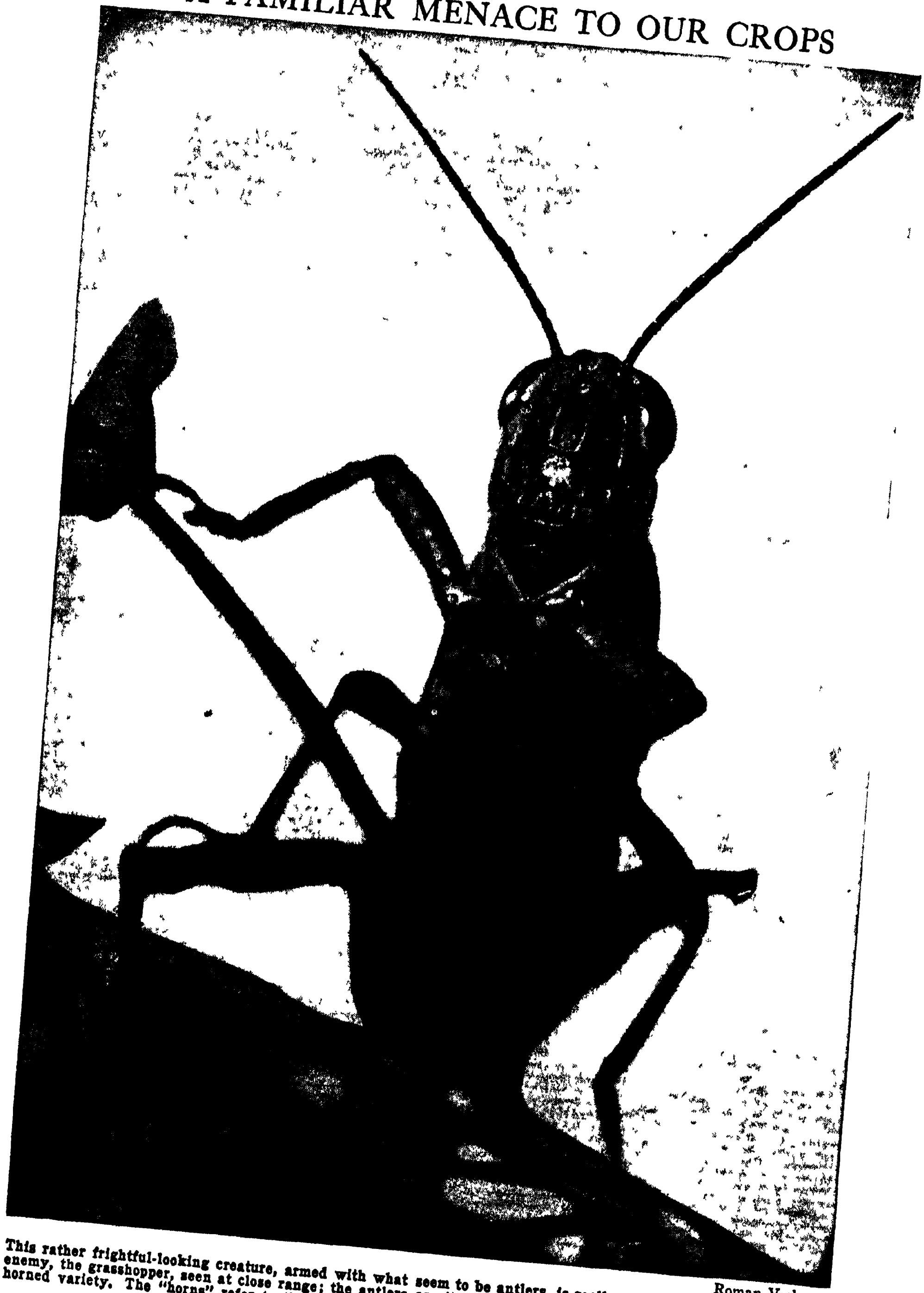
WE have already told you about some of the more familiar insects—bees, wasps, ants, mosquitoes, flies, butterflies, moths, beetles, bugs and termites. We come now to the important order of the Orthoptera (or-thop′-ter-ah) or straight wings. This order includes some insects that you all know about—the grasshopper, the cricket and the cockroach. Other members of the group are the katydid, the leaf-insect, the walking-stick and the mantis.

The name, straight wings, is very appropriate, for these insects have wings folded straight along the body when not used in flight (a few species have no wings). The front wings are thickened. They are really wing cases or covers, under which the rear wings fit when the insect is resting. The straight wings have strong biting jaws with which they chew their food. Most members of the order are vegetarians, feeding on plants. The mantis, however, as we shall see, is a deadly foe to other insects.

The young of the straight wings do not go through the complete series of changes that we saw in the case of the moth and butterfly. When an egg hatches, it generally produces the form known as a nymph—a little insect that resembles the parent, except that, in the case of the winged species, there are no wings. As the nymph grows, it molts (sheds its skin) from time to time. After the last molt the nymph is a full-grown adult insect.

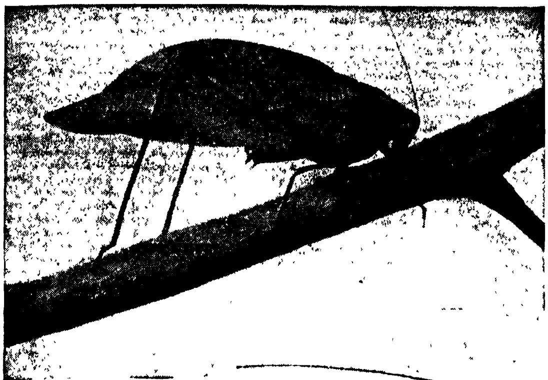
The grasshopper is the first of the Orthoptera or straight wings that we shall describe. For thousands of years it has had the reputation of being a wasteful creature that sings and dances and enjoys the present moment without ever giving a thought to the future. It is represented in this way in the fable of Aesop, which was known in Athens as early as the fifth century B.C. But the grasshopper is not merely an idler and a spendthrift. Certain species of grasshoppers, which men call locusts, have been

A FAMILIAR MENACE TO OUR CROPS



Roman Vishniac

This rather frightful-looking creature, armed with what seem to be antlers, is really our old friend or, rather, our enemy, the grasshopper, seen at close range; the antlers are its antennæ. The insect shown here is of the short-horned variety. The "horns" refer to the grasshopper's antennæ, which are comparatively short and blunt.

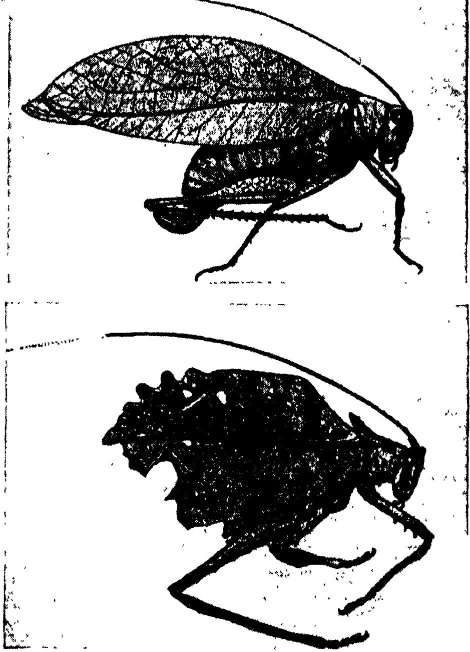


An unusual species of grasshopper that manages to look surprisingly like a leaf.

among the most deadly pests ever known.

There are two families of grasshoppers — long-horned and short-horned. The "horns" really refer to the antennæ or feelers of the insect. In the long-horned variety, the antennæ are long and slender — almost thread-like. In the short-horned group, they are comparatively short and blunt.

Grasshoppers have large heads and eyes. They have thickened forewings, which serve as cases for the hind wings. The hind legs are powerfully developed, enabling the insect to make astonishing leaps. Just think! If you were as remarkable a jumper as the grasshopper, you would think nothing of leaping clear over a six-story building and landing on the other side of it.



Centre pictures, courtesy, Smithsonian Institution

The illustrations in the centre of the page show two species of the shrill-voiced katydid.

The grasshopper has often been described as a great singer. It would be more accurate, perhaps, to call him a tireless, though not very tuneful, fiddler. Like the fiddler, the grasshopper makes sounds by means of friction—by rubbing two surfaces together.

The violinist, you know, produces various tones from his instrument by drawing a bow with a rough surface across a violin string (see page 1798). The long-horned grasshopper rubs together his forewings. One of the two surfaces that come in contact is very rough; the other surface is very sharp. The short-horned grasshopper rubs the inner surface of the hind leg, which is provided with a row of tiny spines, against the outer surface of the front wing.

All species of grasshoppers drill holes in the ground (they do so generally in the late fall), and then they lay eggs in the holes. The drilling is done with a curious organ at the very end of the female grasshopper's

Top and bottom photos, American Museum of Natural History

A remarkable mouse-catching locust, caught with its victim in the Congo district of Africa and now preserved in an English museum.

abdomen; the organ is called, appropriately enough, the ovipositor (Latin for "egg-placer"). In the spring the eggs hatch into little grasshoppers, which resemble their parents, except that they have no wings. As in the case of the other straight wings, the little creatures molt several times. After the last molt they are adult grasshoppers, wings and all.

A few species of the long-horned group do considerable damage to crops; among these species are the Mormon cricket and the Coulee cricket, which are to be found in the western part of North America. Most long-horned grasshoppers, however—including the familiar common green grasshopper and the katydid—are not considered serious pests.

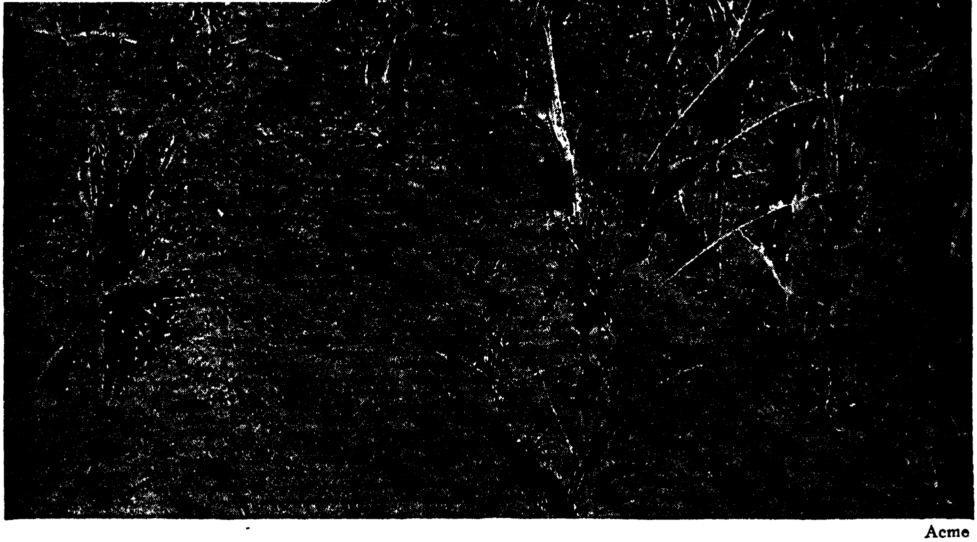
The katydid has a particularly strange call; it sounds something like "Katy did! Katy did!" It is a penetrating sound, for on a still night it can be heard at a distance of a quarter of a mile. The insect, of course, is not interested in telling us about "Katy." Its song is a love-call to the female insect, which answers in a series of modest chirps. The true katydid is an inhabitant of North America.

The most serious harm to crops is done by certain species of short-horned grasshoppers. These are commonly known as locusts or migratory locusts (because they migrate, or wander, from one region to another). They are deadly pests because they appear in such unbelievable numbers. A swarm of locusts that attacked vegetation in the Transvaal district of South Africa was estimated to be twenty-five miles in length, a mile and a half broad and half a mile deep, and it did frightful damage to vegetation.

These insects are particularly bad in a rather dry climate. They are worst of all in years when there is little rainfall, because lack of food causes them to invade areas far from their breeding-places. They rise in countless billions and off they go! At their approach the sky is darkened and the whirring of their wings deepens into a roar. When they settle upon the ground, they

Left: a locust (short-horned grasshopper) busily nibbling at a tempting grain of wheat.

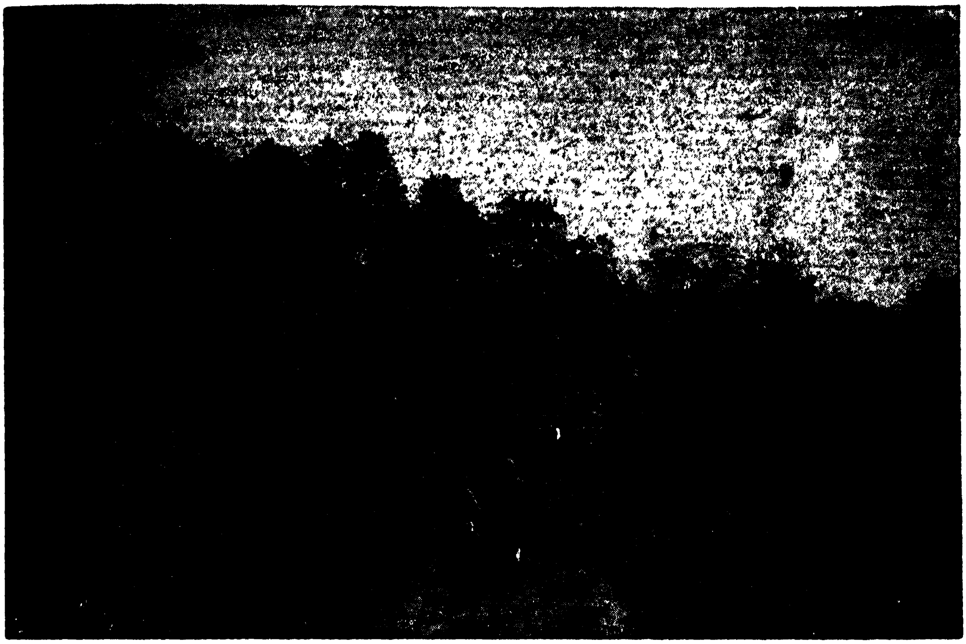
Keystone View Co.



Acme

What a locust swarm can do to a field of corn. By the time the swarm has passed on, only the stalks remain.

WHEN LOCUST SWARMS THREATEN



This photograph shows a swarm of locusts in Tanganyika Territory, British East Africa. The clouds of insects are sometimes so thick that they blot out the sun. They can strip a large cornfield in a few minutes.

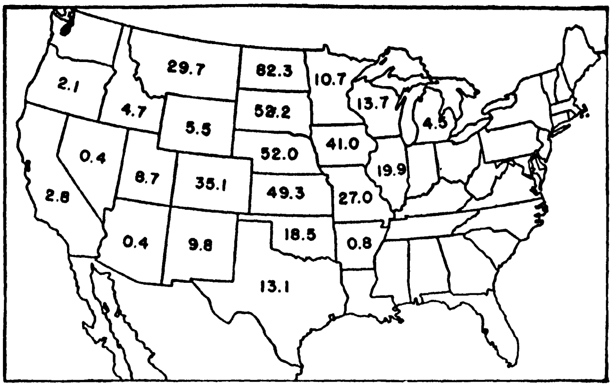
Ewing Galloway and Wide World Photos

When locusts threaten the farming districts of Arabia with destruction, the natives are enrolled in bands to wage war on the insect pests. Each tribe of Arabs sends a certain number of men to take part in the campaign. The above photograph shows the leaders of the campaign taking a roll call of their recruits.

cover everything in sight and they devour every green thing.

Then they advance in a resistless march, sweeping the countryside clear of vegetation. As the work of destruction grows, so does their appetite; when food fails them, they even turn upon one another. A locust plague lasts for a year, sometimes two; often terrible famine is a result.

Locusts have been a curse to mankind for thousands of years. They were one of the plagues with which the Lord afflicted the Egyptians. They have often appeared in Arabia and other regions of Asia and in southern Europe. In North America, a good deal of damage has been done to the crops in the west by the dread Rocky Mountain locust.



Courtesy, U.S. Dept. of Agriculture

This diagram shows grasshopper damage, reckoned in millions of dollars, in the United States from 1929 to 1938. Note that the chief damage is done in the four neighboring midwestern states of North Dakota, South Dakota, Nebraska and Kansas.

A number of measures are taken against these destructive creatures. In some regions a poison containing Paris green and other ingredients is scattered along the edges of crops in districts where the advance of the locusts is feared. The locusts eagerly devour the poison and die. Sometimes wheat fields are protected by a crop of rye sown in a strip around the field and poisoned by spraying with Paris green. Burning over the breeding-places of the creatures is also helpful.

The most effective measure of all, perhaps, is to plow their breeding-grounds very deeply in the late autumn and early spring. In this way the eggs and the young of the locusts are either destroyed or brought up to the surface, where they fall a prey to insects or birds. As more and more of North America has been brought under the plow, the number of locusts has greatly decreased. Certain areas, however, still suffer severely from the pests from time to time. As late as 1940, for example, there was a serious locust plague in the American state of Montana and the neighboring Canadian province of Saskatchewan.

There is a family resemblance between the grasshopper and his cousin, the cricket. There are various kinds of crickets. The true crickets, the most important group, are black or brown insects; they average about an inch in length. Like grasshoppers, they have powerful hind legs, with which they can leap for great distances. Their four wings are not used for flying.

Only the males sing, and they are heard chiefly at night. The sounds, which are produced by rubbing the forewings together, are considered annoying by some people, cheerful by others. In China and Japan, crickets are kept in cages, like canaries, in order to delight their masters with their song.

The two most important true crickets are those known as house crickets and field crickets. Now we all know of the house cricket, which has been immortalized in Charles Dickens' charming story of the Cricket on the Hearth. It is a native of Europe, though it is now also to be found in North America. The house cricket lives in houses, generally near hot-water pipes and behind stoves and ovens. It seldom appears during the day; at night it comes out and chirps away gayly.

The field cricket is more common in North America than the house cricket. As its name indicates, it shuns human dwellings and is content to live in the fields and woods. It generally remains hidden in the ground until nightfall; it then comes out to feed on grass and other plants.

Of the other members of the cricket family, the tree cricket is the daintiest; it is a pale-green little creature that lives on trees and bushes. Since it bores holes in the twigs in order to lay its eggs, it can cause some damage when it is present in considerable numbers.

Finally, we have the mole cricket, a big insect that sometimes reaches a length of two inches. The first pair of legs of this

Keystone View Co.

This unusual photograph shows a cricket chirping away merrily from a pumpkin blossom. The cricket is related to the grasshopper. Like the grasshopper it has powerful hind legs with which it can make great leaps. It has four wings, but these are not used for flying.

insect are short, thick and powerful; they end in great claws. Like the mole from which it gets its name, the mole cricket burrows in the ground, using its powerful claws for digging purposes and raising ridges like small mole hills. The mole cricket digs for its dinner; it is equally fond of earthworms, grubs and roots.

The cockroach is a very disagreeable member of the straight wings family. It eats our food; it leaves an unpleasant odor behind it; it has been known to spread disease. About the only good thing one can say for it is that it preys on an even more disagreeable insect—the bedbug.

The cockroach is a reddish-brown creature with a flat body, which enables it to slip between the tiniest cracks. It has long, sensitive antennæ, which are constantly waving about this way and that. The male has four fair-sized wings; the female has very small wings or, in certain cases, no wings at all. Cockroaches are fairly good-sized, as insects go; some species are several inches long.

The native North American species are outdoor creatures, which live under stones and rotting logs and in damp places generally. The cockroaches that have become household pests on this continent have all been brought in on ships from foreign lands. Europe has sent us the German cockroach; this is often called the Croton bug, because it first appeared when the Croton Dam water system was being piped into New York City. The Oriental cockroach comes from the Far East.

It matters little which species of cockroach one has in one's house; they are equally unpleasant. They are to be found not only in homes but in a great many other places where food is prepared or stored—in restaurants, bakeries, hospitals and ships. They are at home near water pipes and steam pipes, underneath flooring and in walls, where the slightest crack permits them to enter. They have tremendous appetites. They thrive on almost all kinds of food; they have also been known to eat shoe polish, as well as the paste in the bindings of books.

An effective method of ridding a place of cockroaches is to dust the places where they have been found with borax, Pyrethrum or sodium fluoride. To prevent them from entering a dwelling-place, all cracks in floors, walls and around pipes are filled in with plastic wood, putty or plaster.

Some members of the straight wings family are remarkably successful in camouflage—the art of looking like one's surroundings.

American Museum of Natural History
A cricket's leg, greatly enlarged. The whitish object halfway down the leg is the insect's ear.

For example, there is the strange leaf-insect, which is to be found in many countries of the Far East and in India. The insect is broad and flat, with wing-cases that cover the body when they are folded back. These cases have markings just like the veining of leaves; the insect's legs look like twigs with bits of leaf attached to them. Its eggs, which are dropped upon the ground from the foliage where the insect feeds, look much like seeds. Indeed, the wondering natives of India actually believe that this unusual creature is a leaf that has come to life in some marvelous way.

The leaf-insect is a peaceful creature that

Courtesy, U.S. Dept. of Agriculture

How the mole cricket digs its way beneath the surface of the soil in search of its food. This greedy creature feasts on the young of other insects and on earthworms; it is also very fond of roots. Note the ridges that it raises along the ground.

feeds chiefly on leaves. It will occasionally sample the wing-cases of a brother wing insect, but only because, like the rest of us, it has been completely fooled by such perfect camouflage.

Like the leaf-insect, the walking-stick (also called the stick insect and the walking twig) is an almost unbelievable creature. It is, to all appearances, a twig or stick that can walk and eat. Walking-sticks living on the twigs of trees have long, irregularly twisted bodies; those living near thorny plants are sometimes provided with formidable-looking prickles.

Walking-sticks are to be found in tropical regions and in the southern areas of temperate zones. They are sometimes several inches long (one New Zealand species reaches the astonishing length of ten inches). The insects do not move about much during the day; they remain perfectly still for hours at a time. At night they begin to walk about (they have no wings) in search of food. Walking-sticks feed on the green parts of plants. In most areas they are not numerous enough to do much damage. However, in certain regions of Australia, where the walking-sticks are very large, they do considerable damage to trees, since they are apt to strip them of much of their foliage.

A close relative of the walking-stick is the bloodthirsty mantis (or mantid). The mantis, which is found in tropical countries as well as in parts of Europe and North America, is a long, slender creature. It has oval wings and what looks surprisingly like a long neck (this "neck" is really the front part of the thorax; see page 6064). The mantis has a small angular head and bulging eyes. Its four hind legs look much like those of a grasshopper. The forelegs resemble somewhat the arms of a prizefighter. They are immensely strong and are fitted with sharp barbs along the under-surface.

The eggs of the praying mantis are laid in an oval mass, generally upon the stem of a plant. This egg mass is covered with a tough case of hardened mucus, the surface of which shows a curiously braided pattern. For this reason the egg mass may be easily recognized.

Generally the forelegs are doubled up, with the claws held right under the head. To some people this suggests a rearing horse, with forepaws held high; for this reason the mantis is sometimes called a rear-horse in the southern part of the United States. To most people, however, the insect's attitude is like that of a person saying his prayers. It is often called, therefore, the praying mantis or the praying insect.

The creature is not saying its prayers when it holds up its forelegs in that beseeching way; no, indeed! It is on the lookout for some unsuspecting insect on which it hopes to feed. When it catches sight of its prey, the mantis creeps to within striking range. Then, suddenly, those murderous forelegs shoot out like steel springs and the insect is caught on the sharp barbs. The mantis brings the struggling insect to its mouth and chews away heartily.

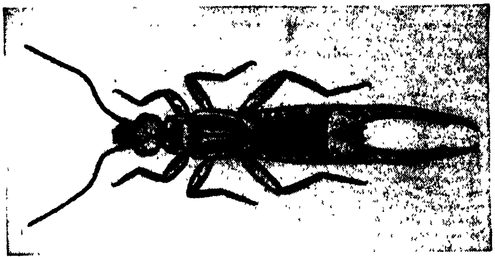
The mantis often turns cannibal. Curiously enough, nothing seems to anger it more than the sight of a brother mantis. There is a grim fight to the death; the victor then proceeds to dine on its conquered opponent. Family ties count for nothing. The female mantis is quite apt to turn on her mate, kill him and then make a meal of him. She can easily do so, since she is larger and stronger.

In Japan and China mantes (this is the plural form of mantis) are sometimes kept in cages and made to fight one another; spectators bet large sums of money on the result of the fighting.

The mantis is certainly not a very agreeable creature. Yet we must consider it as an ally, since it feeds on bugs and beetles and other insects that do great harm to our crops. It is curious to note that some of our worst insect pests, such as plant-lice and boll-weevils, are vegetarians; while some of our allies among the insects are savage killers, constantly on the lookout for new victims.

The earwig is considered by some to belong to the Orthoptera or straight wings. Others hold that it forms an order of its own—the Dermaptera (der-map′-ter-ah) or skin wings. This name has been adopted because the insect's thickened forewings have a leathery appearance. The earwig is a rather small insect, rarely more than two-thirds of an inch long. It has four wings, long feelers and a pair of pincers at the tip of its abdomen.

The purpose of these ugly-looking pincers is not altogether clear. They seem to be used chiefly in folding back the long hind wings of the insect under the wing-cases. However that may be, they have given rise to one of the superstitions to which the earwig owes its name. It seems that some people used to accuse the insect of sewing up a person's ears by using the pincers as needles. Apparently it needed no thread for the task! Other people were convinced that the earwig made its home in our ears. Hence the Anglo-Saxons, who dwelt in England many, many years ago, used to call the insect the "ear insect." The Anglo-Saxon word for "ear insect" was *eārwicga;* in the course of time *eārwicga* became earwig.

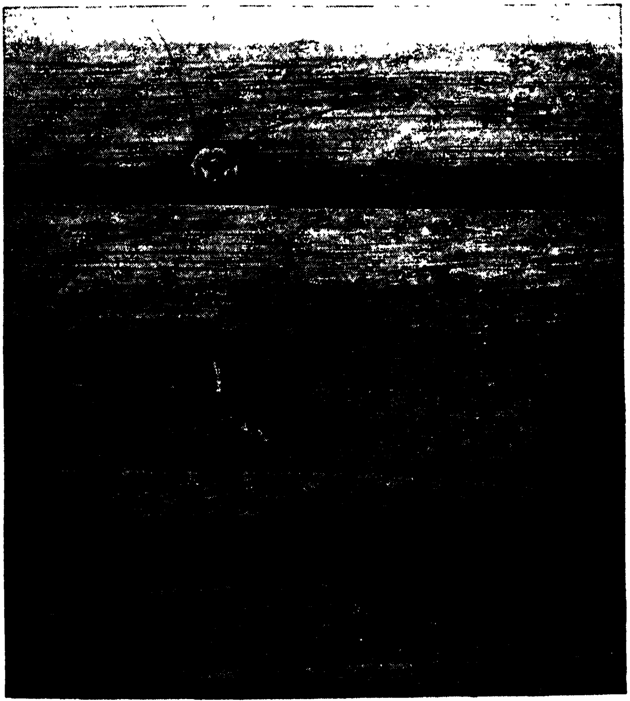


Courtesy, Smithsonian Institution

The earwig. The pincers at the tip of the insect's abdomen are not nearly so terrible as they seem.

As a matter of fact, the "ear insect" does not deserve its bad reputation, for it does not attack our ears. It is a very timid creature and shuns the light. During the daytime it hides beneath the bark of trees, under stones, in the ground or in any suitable hole. It preys on insects; it also feeds on fruits, seeds, leaves and flowers. If earwigs were very numerous, they might develop into a most serious pest; as it is, they generally do not cause a great deal of damage.

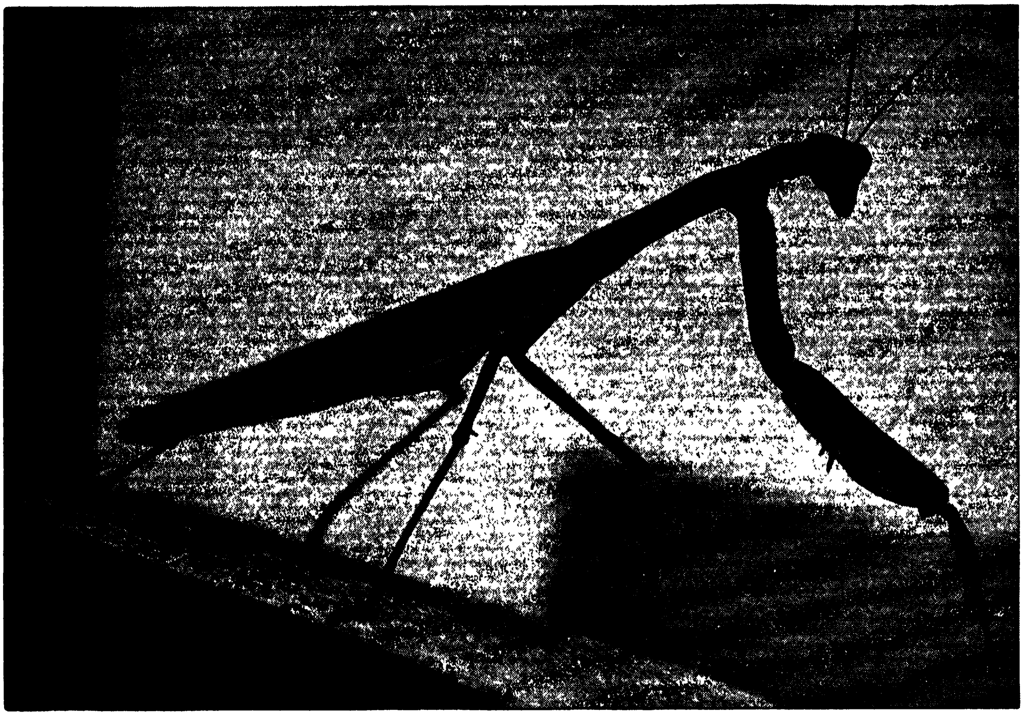
Unfortunately, the same can not be said of the thrips, which is a pest because it is found in such numbers. The thrips (we use the same word in the plural) is a tiny insect belonging to the order of the Thysanoptera (thy-sah-nop′-ter-ah) or tassel wings. The wings of the insect look like little sticks, fringed with hairs that indeed give the effect of tassels. The thrips scratches the surface of plants and then it feeds on the juice



American Museum of Natural History

This photograph shows how cockroaches can slip through the slightest cracks in wooden floors or walls. Cockroaches are very unpleasant creatures, and they have been known to spread disease.

TWO ASSASSINS OF THE INSECT WORLD

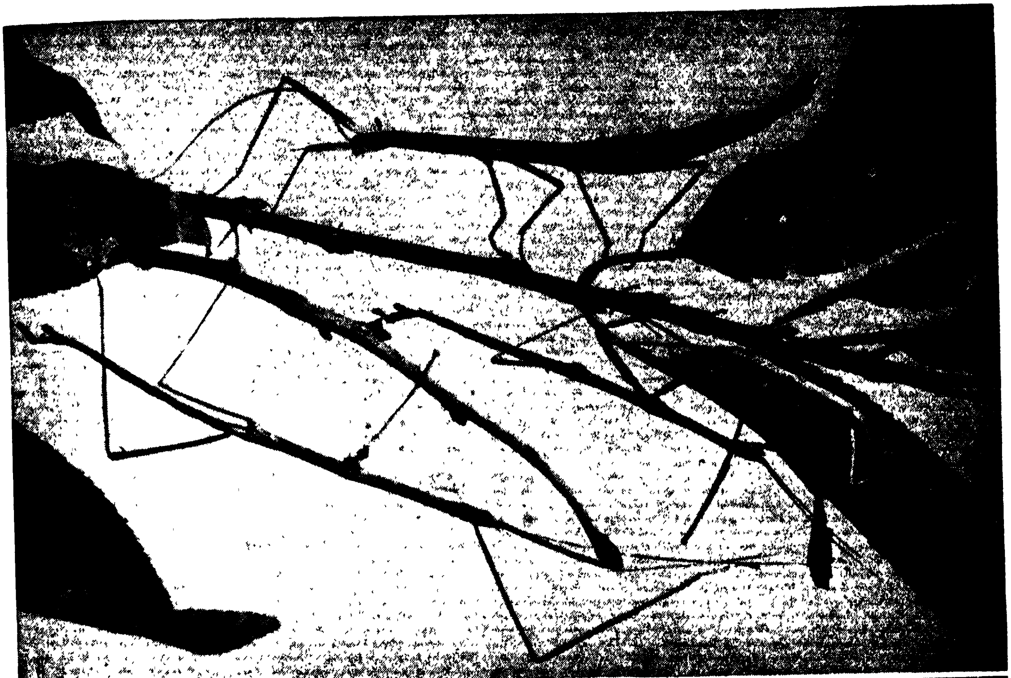


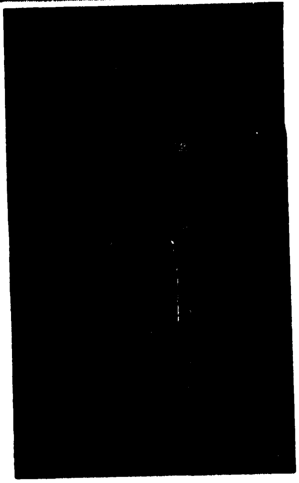
Keystone View Co.

A close-up of the praying mantis. It catches insects with its powerful forelegs, provided with sharp barbs.

American Museum of Natural History

An underwater terror—the water dragon, which is the nymph (young) of the dragon-fly. It is shown here spearing a mosquito larva with its lower jaw, which is like a great paw with two razor-sharp claws at the end.





Both photos, American Museum of Natural History

The above photograph shows a number of walking-sticks. They look so much like the twigs on which they rest that it is almost impossible to tell which is which unless you stand close to them. Can you tell how many walking-sticks are shown here?—Right: another walking-stick, as seen from above.

that comes out of the gashes. Different species of thrips attack garden flowers, oranges, lemons, onions and oats.

The next insect that we shall consider is the dragon-fly. It is a member of the order of Odonata (oh-doh-nah′-tah) or toothed ones—so called because the mandibles or jaws of these insects suggest rows of teeth. The dragon-fly is a large insect, quite often reaching a length of three inches. It has a long slender body and a big head, with immense eyes and short antennæ. Its four long wings, arranged in pairs, are firm and glossy and closely netted with many veins. The abdomen, or hind part, is very long; it is divided into ten more or less equal parts, called segments.

Dragon-flies are divided into two main groups: (1) dragon-flies proper and (2) damsel flies. The damsel fly is sometimes called by the French word for damsel—*demoiselle,* pronounced when taken over in English as dem-wah-zel′. Dragon-flies proper are larger than damsel flies; they hold their wings outspread when at rest, while damsel flies hold them straight up in the air.

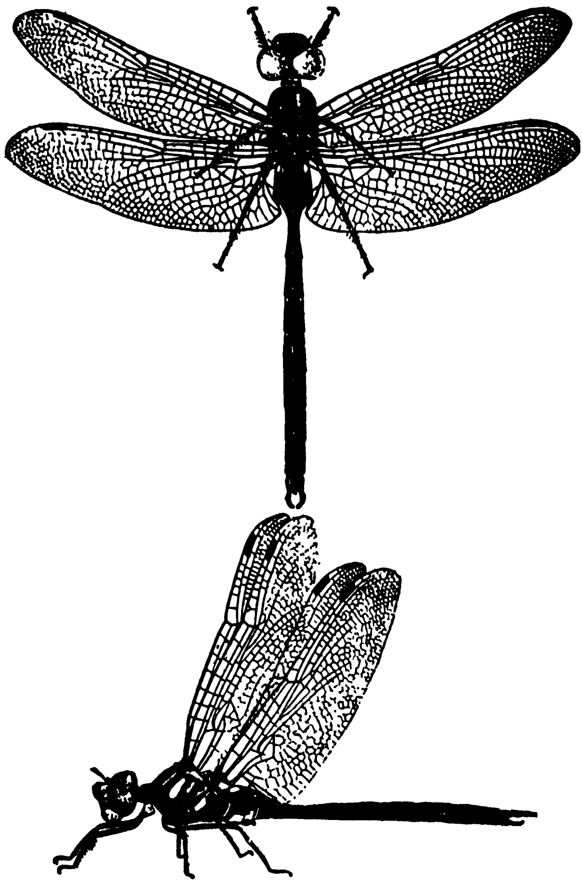
Few insects have as remarkable a life story as the dragon-fly. The female drops its eggs in the water of ponds or brooks; the eggs hatch in the water. The young dragon-fly lives here for the next two or three years. It is a very fierce creature that preys on insects and even on small fish; it is sometimes called a water dragon or simply dragon.

It has a short, thick body, with a large and flat head and large eyes. Its lower jaw is like a great paw with two sharp claws at the end. This "paw" is generally tucked back under the insect's head. When an insect victim approaches, the "paw" suddenly shoots out and the claws fasten on the victim, upon which the water dragon feasts.

The water dragon can crawl around on its legs and can also push itself along by squirting water from its body. However, it is not a very nimble creature; it generally lies in wait for its prey, instead of actively pursuing it.

As the water dragon grows, it sheds its skin again and again. At last the time comes when it is ready to leave its watery home. It crawls out of the water and rests upon a stone or a reed or the root of a tree at the water's edge. The old skin cracks; from it there comes a sad-looking creature, with limp body and moist wings held close to its sides. It is too weak to move for a time. Then, little by little, it gathers strength; its body becomes firm, its wings dry out and begin to flutter. At last it is ready for flight; suddenly it is off.

From the very beginning of its career above water, the dragon-fly is a great hunter. Darting hither and thither over ponds, brooks and fields, it preys on flies and mosquitoes and sometimes on larger creatures like moths and butterflies. The larger species of dragon-flies sometimes attack and devour the smaller ones.



Courtesy, Smithsonian Institution

Two views of the dragon-fly, one of the most graceful of all insects. Since the dragon-fly never attacks man and since it preys on the mosquito and other enemies of man, it is reckoned as one of our chief allies in the insect world.

The dragon-fly never attacks man or his domestic animals or his crops; furthermore, it preys on some of the deadliest insect enemies of man, particularly the fly and the mosquito. Hence it is one of our most valuable allies. It is hard to believe that it was once held in dread by ignorant and unthinking people.

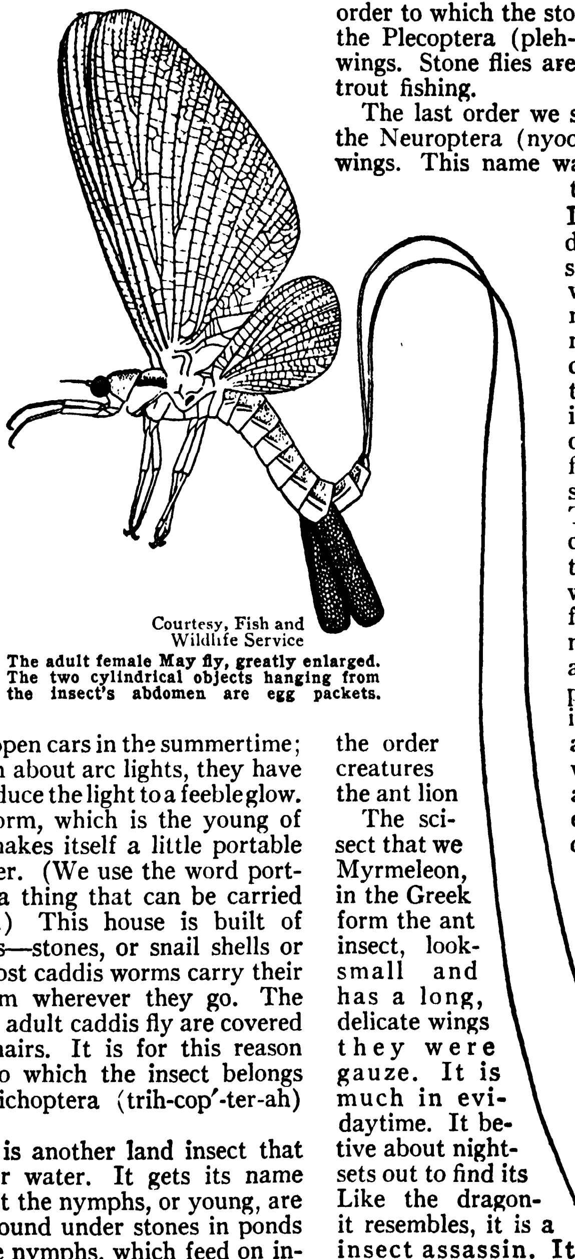
Some called it the darning-needle and claimed that it sewed up the lips and ears of naughty children. Others referred to it as the flying-adder and the horse-stinger because it was supposed to carry a poisonous sting in its tail. Certain Negroes in the southern part of the United States held the strangest belief of all. To them the dragon-fly was known as the snake-doctor because it was supposed to feed and nurse sick snakes! The names of darning-needle and horse-stinger and snake-doctor still remain, although the superstitions that gave rise to them are rapidly disappearing.

The young of other insects also live in the water during their growing period. The little May fly (it is also called the day fly) hatches from an egg in the water and becomes a long, thin creature with a three-pronged tail. It crawls along the bottom of the pond or stream where it was born, preying on insects and feeding on vegetation.

This stage lasts for quite a while —for a year or two. Then the insect crawls out of the water and, shedding its skin, becomes an adult May fly–a pretty little creature with delicate wings and a very long triple tail. May flies appear in great swarms toward the early part of summer. They veil the surface of ponds or brooks; they cover the screens of our houses; they bump against arc lights. They appear to dance away in the height of gladness.

Yet the May fly is doomed from the very moment that it becomes an adult—doomed to starvation because it can not take any sort of food. In its feverish activity, it soon uses up its scant supply of energy; its life span is generally only a day or two. You can see now why it is sometimes called the day fly. For the same reason the name Ephemeridæ (ef-eh-mer′-i-dee) or creatures of a day has been given to the order to which the May fly belongs.

Since the May fly can not eat, it is clear that it can not do harm to man's crops. Since it can neither bite nor sting, it can not attack man or the domestic animals of man. Yet it occasionally appears in such great numbers as to be very annoying. In certain sections of the Great Lakes area, for example, the May fly sometimes causes great discomfort to people who go riding in open cars in the summertime; when they swarm about arc lights, they have been known to reduce the light to a feeble glow.



Courtesy, Fish and Wildlife Service

The adult female May fly, greatly enlarged. The two cylindrical objects hanging from the insect's abdomen are egg packets.

The caddis worm, which is the young of the caddis fly, makes itself a little portable house under water. (We use the word portable to refer to a thing that can be carried about with one.) This house is built of various materials—stones, or snail shells or bits of straw. Most caddis worms carry their houses with them wherever they go. The four wings of the adult caddis fly are covered with very fine hairs. It is for this reason that the order to which the insect belongs is called the Trichoptera (trih-cop′-ter-ah) or hair wings.

The stone fly is another land insect that is hatched under water. It gets its name from the fact that the nymphs, or young, are generally to be found under stones in ponds or brooks. These nymphs, which feed on insects, change into adults in much the same way as the young of the May fly. Unlike that unfortunate little insect, however, the adult stone fly is well able to take care of itself, since it feeds eagerly on other insects.

The stone fly is a curious-looking insect with a long forked tail. The hind pair of its four wings is so long that it is folded over when the insect is at rest. Hence the order to which the stone fly belongs is called the Plecoptera (pleh-cop′-ter-ah) or folded wings. Stone flies are much used as bait in trout fishing.

The last order we shall discuss is that of the Neuroptera (nyoo-rop′-ter-ah) or nerve wings. This name was originally given by the great naturalist Linnæus (see the Index) to a number of species with net-like wings, suggesting the net-like arrangement of nerves. Linnæus included in the order of the Neuroptera such insects as termites, dragon-flies and stone flies, which are now assigned to other orders. The Neuroptera have come to include only the net-winged insects which pass through four stages of development—egg, larva, pupa and imago or adult (see page 6065). The most important members of the order are the two unusual creatures which are known as the ant lion and the lacewing.

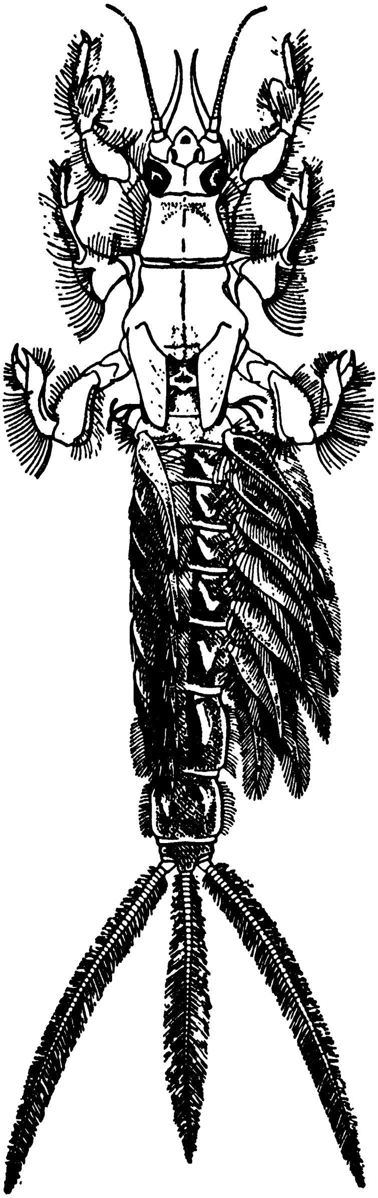
The scientific name of the insect that we call the ant lion is the Myrmeleon, which means ant lion in the Greek language. In its adult form the ant lion is a pretty little insect, looking something like a small and dainty dragon-fly. It has a long, slender body and delicate wings that look as if they were made of fine gauze. It is generally not much in evidence during the daytime. It begins to be active about nightfall, when it sets out to find its next meal. Like the dragon-fly, which it resembles, it is a sort of insect assassin. It hunts moths and flies and other insects. It owes the name of ant lion to its larva or young, which is a fierce killer.

The larva is an ugly little creature, hairy all over. It has a broad body, small and feeble legs and a flat head, provided with a pair of long, curved jaws, very sharp at the tips. Since this little creature is too slow to pursue its prey, it entraps victims instead. It digs up a funnel-shaped pit in the ground, generally in dry and sandy soil. It then conceals itself at the bottom of the pit, with only its jaws showing, and waits for its victim.

Soon an ant comes up to the very edge of the pit. The loose sides give way and the ant begins to slide down toward those terrible jaws. Aroused, the ant lion, using its flat head as a shovel, flings showers of sand at the struggling ant, which at last completely loses its footing. Down it rolls into the bottom of the pit and to the waiting jaws of the ant lion. This insect also eats small beetles, flies and other insects.

The ant lion lives in its pit for a time, growing plumper on its generous insect diet. One fine day it spins a silky cocoon for itself; the outside of the cocoon is covered with grains of sand, held together with the silky thread that the insect spins from its body. The ant lion rests in the cocoon for a time. When it comes out at last, it is the graceful adult insect.

The cousin of the ant lion, the lacewing, is a gorgeous creature, with green body, green lacy wings and large eyes that glow in the sun like balls of fire. You would do well to shun it, however, for it gives off a very disagreeable odor — its chief defense against birds and insect enemies that might be tempted to dine on it. The lacewing is the skunk of the insect world. Both lacewing and skunk are pretty, but—



Courtesy, Fish and Wildlife Service

Would you ever suspect that this ugly creature (enlarged many times) is the nymph, or young, of the May fly shown on the preceding page? Unlike the adult which can not feed and soon dies of starvation, the nymph is a hearty eater.

The lacewing settles upon a leaf from time to time and deposits a drop of fluid from its body. It then draws the drop out away from the leaf into a little silk thread, at the very end of which it lays an egg. When the egg is hatched, the larva makes its way along the thread of silk until it reaches the leaf. It is a small, homely creature, with long, pointed jaws; and it is terribly hungry. Soon it finds itself a meal in the form of an aphid (also called aphis or plant-louse).

This only serves to increase the appetite of the larva. It begins to feast on all the plant-lice in the vicinity (and there are generally plenty of them). Small wonder that the larva of the lacewing is often called the aphis lion.

The larva does not confine itself to aphids, however; it is fond of other insects and of insect eggs as well. Finally its larva days are over. It spins a cocoon for itself on a leaf, and rests for a time. Then it cuts almost completely around the top of the cocoon with its jaws, pushes up the lid that is formed in this way and comes out as a full-grown lacewing.

Mankind has every reason to wish the Neuroptera or nerve insects well. They tend to cut down greatly the insect population in their vicinity—a population that might easily become too great for our comfort. The larva of the lacewing, in particular, does us great service by its attacks on the aphid, one of the most destructive little creatures in the entire insect kingdom.

THE NEXT STORY OF ANIMAL LIFE IS ON PAGE 6793.

Philip Gendreau, N. Y.

Facing eastward toward the sacred shrine of Mecca, these Mohammedan Arabs kneel to pray in the Sahara Desert.

THE PEOPLES *of the* DESERT

THE WILD, FREE TRIBES OF THE EARTH AT HOME

A BURNING expanse of red, gray, brown or white sand, thinly dotted with oases of wells and grass, and diversified with stony and rocky tracts—that is the scene which springs up in imagination at the very mention of deserts. The mind at once flies to Arabia, the typical land of wilderness desolation, or to the vast African Sahara, for these two regions have always been, above all others, representative of the desert.

But the world's great deserts are vaster and more varied than most of us realize. There are many great uninhabited wastes in the world, caused chiefly by the lack of rain.

The most extensive of all the Asiatic wildernesses is The Gobi, the desert in Mongolia. Arizona, one of the largest states of the United States, contains one of the biggest deserts of the New World. Other regions are arid and barren, bearing nothing but sagebrush and cactus. One of the most dreaded of the deserts is that in the interior of Australia.

The Arabian and African wilderness regions must ever exercise the most fascinating influence on our minds. Consider the ways, for example, of the various tribes of Arabs. They are divided mainly into two sections—those who inhabit towns, some on the borders of the desert, others within the wastes; and those who restlessly wander here and there. Now, the wandering, or nomad, Bedouin is very interesting. He has a hard life, but it is a very healthful one, and in some respects it is a happy existence, with its absolute freedom from town restraints and its enjoyment of the pure sweet desert air.

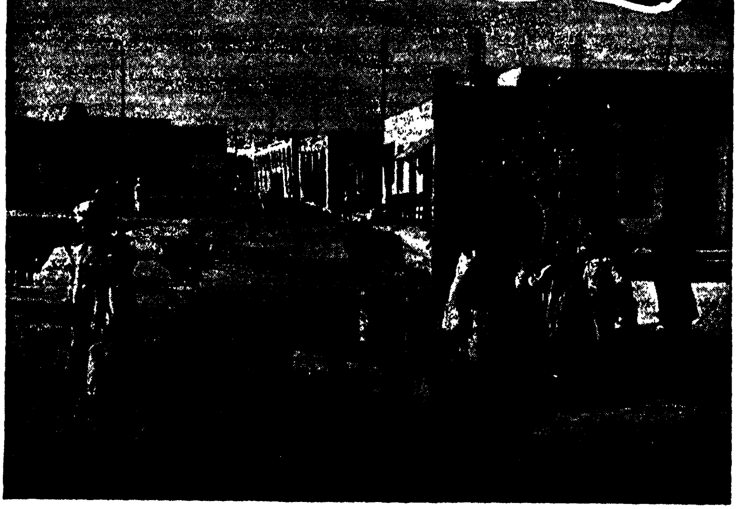
Two of the largest and wealthiest of the Arab tribes are the famous Anaeze and the Shommar. These tribes, and several others, are often at war, one against the other, and the settled existence to which we are accustomed is unknown to them. All except one particular tribe possess splendid horses. Carrying very long spears, often measuring twelve feet, pointed with steel lances, the Bedouin horsemen riding on these lovely steeds present a fine spectacle, especially

LIFE IN THE DESERT OASES

Pottery drying in the sun at a pottery shop in Nabeul, Tunisia. These wares are of a fine quality, and are much in demand among the Arabs of Tunisia.

All pictures on this page, Screen Traveler, from Gendreau

At this desert oasis in Tunisia Arabs are sorting and packing dates, which are their chief article of food. There are many such oases in the Sahara Desert.



Sometimes an oasis may be quite a large settlement. Here is the oasis town of Tozeur in Tunisia, with its public fountain for man and animal.

when they indulge in the picturesque games in which they delight. They are fond of galloping and racing, and they like also the exercises in which they play at war.

Arab steeds are so well trained as rarely to need an iron bit. The ordinary Arab bridle is almost the same as our halter strap. The desert horse seems to understand its master, and almost to interpret his will by a movement or touch. Most of the horses belong to the sheiks, or head men of the tribes, and, except when they are needed, are kept at some distance away from the camp.

Screen Traveler, from Gendreau

Merchants unroll and display their wares at the mat market in Nabeul, Tunisia. The Arabs weave mats from the leaves of the palm trees and decorate them with graceful Arabic designs in vivid colors.

The Arab term Bedouin means "desert-dweller," and the traveler must wonder how these Bedouin tribes can exist at all in a vast sandy or rocky waste. Of course, there are great sandy areas, but a large part of the Arabian wilderness is a desert simply in the sense that it has no settled population.

If all were absolutely barren, these nomad Arabs could not live and prosper, and grow wealthy as some of the sheiks do. The fact is that very large tracts of the soil are excellent. In springtime, after a heavy rainfall, northern Arabia becomes like our prairies over large areas. Lovely wild flowers spring up that would delight the heart of a botanist. This explains why the wandering Bedouins are rich in the possession of thousands of cattle, camels, horses, sheep and also goats.

Dr. Zwemer, who lived on the Bahrein Islands in the Persian Gulf, and who traveled much as a devoted missionary among the desert tribes, said: "I am sure you can still find some of these Bedouin chiefs who, like Job, have seven thousand sheep, and three thousands camels, and a great household."

THE DESERT FOLK LIVE IN BLACK TENTS WOVEN OUT OF GOAT'S HAIR

Just as in the time of Job, so do these children of the desert today dwell in black tents made of goat's hair, which forms a perfect waterproof covering. These tents are square or oblong in shape.

An Arab desert camp is a singular spectacle, but it is well worth visiting. For the journey into the desert to some outlying spot, presents should be taken and a guide is needed. The guide walks barefooted, for he prefers to carry his sandals tucked in his girdle.

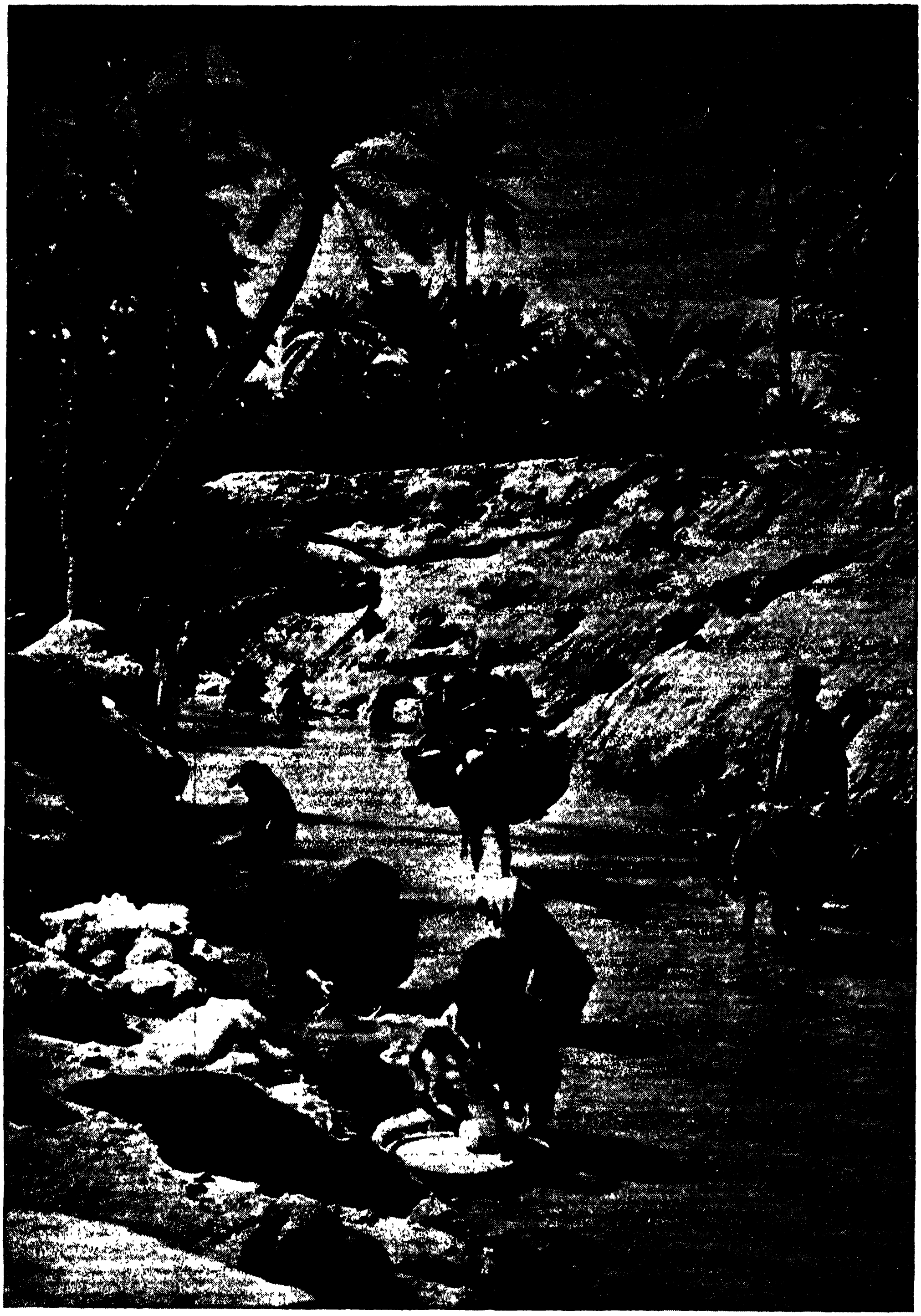
Presently we come to flocks of sheep with their shepherds, who direct the guide to the camp. This never remains more than a month in one spot. It is sure to be pitched in some hollow, the deepest that can be found, for two reasons—the necessity of concealment from hostile bands of fellow-Arabs, and the advantage of shelter from the hot winds.

The great encampment is carefully arranged. Some tribes spread their tents in a great square in rows; other prefer a picturesque oval. One feature never is lacking—the symbol of the authority of the sheik. This little king always plants his spear in front of his tent. Just behind it is the section curtained off for the reception of guests. And how effusive is the hospitality of these Arabs! Their kind courtesy to visitors never fails. Never is a Bedouin of the wilderness known to violate the beautiful law of hospitality. Out of the burning sunshine the weary traveler is welcomed. The women hasten to bring him water to cool his head. A great bowl of camel's milk is offered before any questions are asked. At night a fat kid or lamb will be killed, and a feast provided.

WHY THE TENTS ARE SO BIG AND WHY THEY ARE BLACK

There are real luxuries in the Arab tents. The tents are spacious, for they will accommodate considerable quantities of several sorts of grain, chaff, fruits, dried fish and wood. There is also ample room for refuge for fowls, goats, some cows and a horse or two. The great main room has in the center a large hollow which serves as the fireplace.

IN THE DESERT, WATER IS LIFE



Screen Traveler, from Gendreau

Water is precious in the desert lands. The stream in this oasis serves man and beast.

Pictures from Philip Gendreau, N Y.

An outdoor sheep market in a street of Bagdad, Iraq. At right, an old sheep herder from the desert country, with his staff.

The smoke must find its way out as best it can, so in time the tent becomes blacker and blacker; indeed, the old Bible phrase which speaks of the "black tents of Kedar" is as applicable now as then.

One great blessing is the famous porous jug. The Arabs who live and work in towns make unglazed water-jugs and jars. These are an unspeakable boon for the people, for they have no ice. The wells are never very deep, and the water comes from a long distance. Thus, if it were not for water-jugs of this kind, cold water would be unknown. How, then, is it cooled? Very simply. If poured into one of these porous earthen pots and hung for a few minutes in the wind, the effect is astonishing, for the beverage becomes deliciously cold and refreshing by evaporation.

Palatable and wholesome is the desert fare. There are luxuries also in the food, though we should hardly relish the favorite dishes of the tribes, such as leben, the peculiar sour milk of mares and camels, which in Turkey is called yoghurt; pilaf, or pilau, which is rice beautifully cooked and containing little shreds of lamb or kid or chicken. When the Arabs make a great feast in the desert, they roast a sheep or goat whole on red-hot stones. Hard biscuits in the shape of rings, called kak, are much relished, and so is the peculiar butter called ghee. When the Arabs have to carry water about, they do so in great leathern bottles made of the whole skins of sheeps and goats, rather than in rigid jars.

One beverage that is enjoyed in the desert can not be excelled anywhere in the world. Coffee was first brought to Arabia from Ethiopia about the year 1400 by a pilgrim, whose tomb in Yemen is an object of veneration; and the seeds planted in Yemen produce the Mocha coffee which is so famous.

The chief of all foods among the desert peoples is the date, and the most precious thing that grows in the countries inhabited by these tribes is the date-palm, one of the noblest and most graceful of all trees. The Arabs of the desert eat much wild honey, and will feed abundantly on locusts when they can; they also feast eagerly on the big lizards that dart among stony places, and do not disdain even the jerboa. But the great article of diet is the date, without which the Arab of the wilds could hardly subsist. A joyous time is the festival known in the

SCENES IN MOROCCO AND TUNISIA

An Arab rides to market on donkey-back, with a fine load of dates to sell.

A market scene in a Morocco town, showing the Arab headdress and long, loose garment.

Near a palm grove in a desert oasis these Bedouins, or desert Arabs, have pitched their large tent.

All pictures on this page,
Screen Traveler, from Gendreau

A story teller in Marrakesh, Morocco, holds the close attention of his listeners. Perhaps he is relating some modern tale, or perhaps one of the ancient stories of the Arabian Nights.

springtime as the Marriage of the Date-Palms, when the soft spring breezes waft the pollen from the male to the female blossoms.

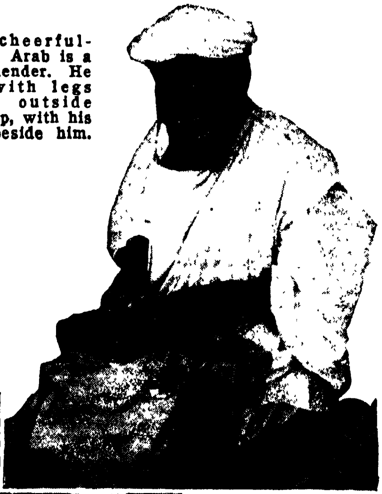
Arab children are never happier than when they are sucking sugar-cane, which is cut into pieces and sold by the knot—that is to say, by the length of the stick from one knot to the next. But nothing is so abundant as dates. Sometimes for many weeks nothing else will be eaten in an Arab tent, and even the donkeys and camels are fed on this fruit. Outside many a tent at this moment will be Arab boys and girls playing games with date stones on the smooth sands. The date stones are not thrown away, but are ground up into a coarse kind of meal for cattle food. Indeed, nothing is wasted that belongs to the date-palm. The fragrant blossoms make a favorite beverage, and if the fruit that has not been consumed turns stale and somewhat musty, it is converted into vinegar. The leaves are woven into strings, fans, mats and baskets, and the long, thin, strong branches are made up by the carpenters in the towns into chairs, cradles, cages, beds, boats and countless other things.

One event in the desert is always exciting. This is the breaking-up of a camp for a migration. When a tribe shifts its quarters all possible preparations are made on the previous day, and early in the morning everything is in motion for the great departure.

Tents are taken down and packed, and soon the country is full of camels and flocks and herds and Arabs. Sometimes ten or a dozen camels will be arranged in procession at considerable intervals from each other. To the back of each camel are fastened four upright poles, which support a canopy called a merkab. On this erection rides an Arab girl, prostrate on her breast. These girls are always the sisters of heroes—men who have won fame in battle.

The Bedouin Arabs have no schools and few can read and write. They are temperate, for as Moslems they should not taste intoxicants. There are no mosques in the deserts, of course, but these children of the wilderness pray faithfully. The first chapter of the Koran is recited in every tent five times a day, while the worshipers prostrate themselves toward Mecca.

Caravans—what scenes this word conjures up! The longest and most perilous caravan



This cheerful-looking Arab is a shoe mender. He sits with legs crossed outside his shop, with his tools beside him.

Pictures courtesy of Screen Traveler, from Gendreau

A street scene in Rabat, Morocco. A tailor shop, with its owner sitting outside at work. He and his family live behind the shop.

expeditions are those which cross the great Sahara, and this vast African desert has wonderful fascination. One of its marvels is the mirage, the reflection in the sky which has puzzled so many travelers in ages past.

Distressing have been the experiences of the members of great camel caravans crossing the Sahara, parched with thirst, under burning skies, suddenly plunged into ecstasy by the full view of palm trees forming an oasis at a little distance—for palm trees always mean a well close by. In some sad instances the travelers have rushed on to find that they had been mocked by a mirage, and men and beasts have perished for lack of water. We explain mirages elsewhere in our book. Look for the word in the Index.

The towns that border the deserts often lie in the center of surrounding barren solitudes, as does Damascus, the oldest city on earth, where are lovely gardens watered by fountains from Abana and Pharpar, the twin rivers that rush down from the snows of Lebanon.

Philip Gendreau, N. Y.

The tower in this picture marks the tomb of the Shaikh Omers, one of the monuments of Bagdad in Iraq. The mounds that you see outside the walls are the tombs of an Arab cemetery. In the center of the picture is a flock of sheep and their shepherd. The desert land can be seen in the background, stretching into the distance.

Spots of enchantment in the Libyan Desert of Africa are the oases, great patches of vegetation caused by the presence of springs. Four very large and beautiful oases are inhabited by the great and famous tribe of Mugrebi Arabs, who love their gardens and villages embowered in date-palm groves, with sparkling streams ever refreshing them.

One of the most dreaded perils of the desert is the hot wind called by the Arabs the simoon. When this fierce and burning blast sweeps across the vast wastes it is deadly in its effect. Everyone in a caravan must, in order to escape alive, kneel in the sand with the mouth close to the ground, and, if possible, in the shelter of a camel, a roll of bedding or even a saddle.

The town-dwellers are gifted and clever. They excel in some crafts, especially in various sorts of woodwork. That delicate and ornate latticework which is seen in windows, doors, boxes and cabinets is highly prized. Glass for windows is rarely used in Arabia except by Europeans or by a few Arab families who have learned some of the Western ways. But in Arab houses are to be seen some of the loveliest windows that can be imagined.

The Arabs call a window *shibaak*, which means "network." The joiner fashions a most delicate fabric out of date-palm wood or bamboo, making little round bars, and fitting these to each other in a great variety of decorative designs. Through this fine latticework light and air come into the room, but none can look through upon the inmates from the outside world.

From behind such windows the Arab women look out upon what goes on in the courtyard of the dwelling. In Arab homes special quarters are reserved for women. Into these strangers are not admitted except on rare occasions. The Arab way of life is slow to change, even today.

THE NEXT STORY OF ALL COUNTRIES IS ON PAGE 6763.

SCENES NEAR BAGDAD IN IRAQ

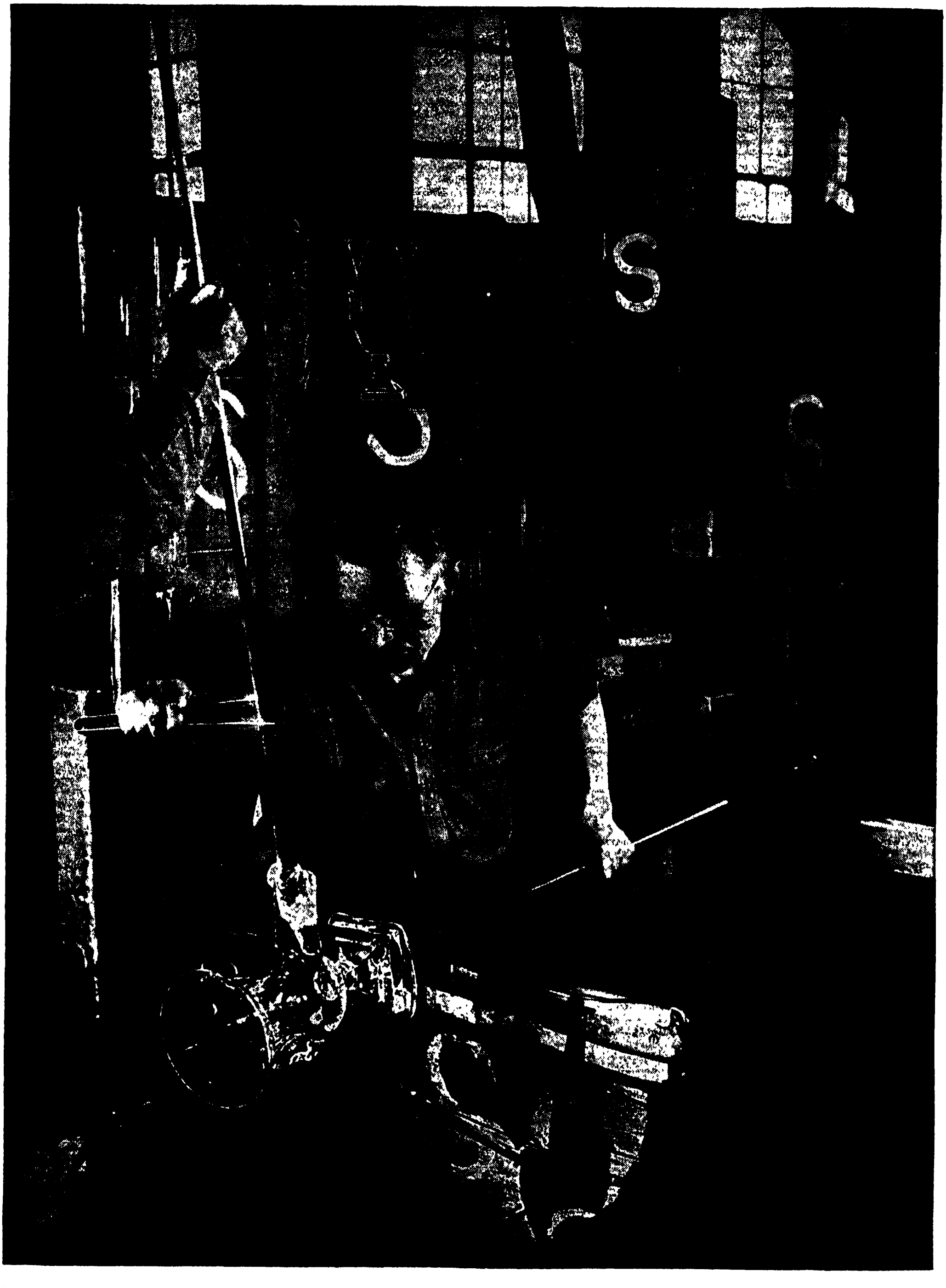
Bagdad lies on a bank of the Tigris River. Even in the ancient days of the Babylonian empire, canals were dug and water was thus brought to the fields. Here we see Arabs of today washing radishes in one of the canals.

All pictures on this page from Philip Gendreau, N. Y.

From their flocks of sheep the Arabs clip the wool. Then it is graded for type and quality. These women are grading the wool, which will then be sold or used to make clothing, rugs, tents or other articles.

Washing and drying lamb skins. These are spread out in the open and then covered with salt mixed with flour to draw out the acid of the skins and to keep the fur in good condition for shipping.

SHAPING A FINE PIECE OF GLASSWARE BY HAND



During the centuries since glass has been known, the glass worker has been a master craftsman creating each piece with pride of workmanship. His place has been taken, to a large extent, by machinery but some pieces are still made by hand. The tools used in shaping this beautiful urn are the same as those used centuries ago.

Photographs on pages 6744, 6745, 6746, 6747 and 6751, courtesy, Corning Glass Works

A mixture of sand, soda and lime being poured into a tank furnace to be melted into glass.

HOW GLASS IS MADE

IMAGINE what the world would be like without glass! Windows, mirrors, electric light bulbs, glassware for our tables, glasses that we use to read by, and thousands of other familiar items that we depend upon every day would be unheard of in a world devoid of glass. Yet, to-day, glass is so common and much of it is so cheap that we seldom stop to think about its importance in our daily lives.

Our modern science uses glass constantly. Without it our knowledge of astronomy and chemistry, medicine and the other sciences of living things would be greatly retarded, and in some cases would never advance very far. Without the telescope we would know little of the universe. Without the microscope we should be ignorant of many facts upon which both our knowledge and our well-being depend. Without the camera we could not take pictures—and just think of a world without photographs!

Many of these uses of glass are new, but the world has known of glass for thousands of years. It is generally believed that the Egyptians were the first to make the substance, but some believe that it was first used in Syria. Glass vessels many thousands of years old have been discovered in both countries. Beautiful bowls were made in Phœnicia, Persia and India long before they were known to Western Europe. The Greeks were not great glassmakers, but there is much wonderful Roman glass. In Rome it was even used for windows in a few houses, and Italy has been famous for its beautiful objects of glass from very early times. Venetian glass is known everywhere. Constantinople is another city famous for its skillful workers in ornamental glass. It is said that some of the ancients knew how to make malleable glass, that is, glass which would bend like metal when dropped, rather than shatter to bits.

From the East, or more properly, the Near East, glassmakers introduced their art into Western Europe, and soon it became widespread. Kings gave special privileges to the glassworkers, who were very proud, and wealthy people valued some of their glass treasures more highly than gold or silver. Some of the colored glass made for the windows of the great churches and cathedrals is finer than that made to-day. But in the Middle Ages glass was so expensive that the common people could not have vessels of glass, and never thought of having glass windows. Only within the last hundred years or so has glass become cheap enough for common use. Light formerly was admitted into houses through holes in the walls or in the roof. In stormy weather these openings were often closed by heavy shutters, and the house was dark. Sometimes oiled paper or thin cloth was stretched over the openings. These let some light in, but one could not see through them. Not very long ago the fact that a man had glass windows in his house was supposed to show that he had considerable wealth, and he was taxed on the number of these windows.

Among the earliest settlers of Jamestown, Virginia, were some glassworkers, and in 1639 glass was made in Massachusetts. Before the American Revolution several other factories were set up in different colonies, and now there are several hundred in different parts of the North American continent. Though there are so many, much glass is still imported. A great deal of optical glass comes from Germany; table glassware from Japan, Germany, Belgium, Italy, and Great Britàin, and modern decorative glass from Sweden. Mexico also sends us some glass, most of which is colored.

Red signals for railroads are made by blowing glass. The workman takes the lump of partly blown glass and puts it in the mold, seen below, then blows until the glass has taken the shape of the mold.

WHAT IS GLASS AND HOW IS IT MADE?

There are many different kinds of glass, but all of them have silica as their chief ingredient. Silica comes from sand, particularly the kind of white sand that you find along the seashore. But all kinds of sand cannot be used to make glass, because many of them contain impurities which would discolor or change the hardness of the glass. Large quantities of iron, for instance, would give the glass a greenish tinge such as you have seen in cheap window glass and tumblers while other substances give other colors. Therefore special kinds of sand must be found. Some of this sand is made by crushing quartz or sandstone; some is obtained from the seashore and from the beds of streams; and some of it is taken from the land.

Sand alone, however, cannot be made into clear glass. Some other things must be added. The most important are different forms of soda, lime, lead, potash and borax. The purpose for which the glass is to be used decides which of these and how much is to be mixed with the sand.

In ordinary glassmaking the sand, soda and lime are thoroughly mixed and shoveled into a pot or tank in an intensely hot furnace, together with pieces of broken glass and lumps of "cullet," which is simply glass which cooled before it was used. After several hours of heating, these materials fuse together. The mixture is not liquid, like water, but it is more like tar or very thick molasses. When colored glass is desired the coloring matter usually is added when the materials are melted. This is not a dye, but a mineral which combines with the glass.

THE PICTURESQUE GLASS-BLOWER AND HIS WORK

There are several ways of dealing with molten glass. For the blowing of fine glass, a group of about seven men, comprising what is known as a "shop," gather around a small furnace. The man in charge is called a "gaffer." This is an old English term that comes from the word "grandfather." In the olden days, only the older men who were very experienced could be trusted with glass-making, for it was a job that required great skill. This still holds true, for the same methods and tools that were used as far back as the Roman days prevail in making fine glassware to-day.

The gaffer takes a long steel tube, thrusts it into the pot and collects a "gather" of molten glass on the end. Then he blows through the tube, and the lump at the end swells out into a bulb. By swinging the tube, and then rolling it on a block while he shapes the soft glass with a wooden paddle, the workman forms the bulb to approximately the shape of the finished piece. In the meantime his assistant takes another small gather of glass from the pot and hands it to the gaffer who then fuses it to the bulb and shapes it into the form of stem and bottom. Throughout this process, the gaffer frequently must reheat the bulb so that it will retain the right amount of softness. This is a delicate manœuver, because he must be very careful not to heat it too much. After the bulb is finished, it is still very hot and must be placed in a special oven where it gradually cools to room temperature. This cooling, or annealing, process, as it is called, reduces internal strain, and prevents the finished piece from breaking too easily.

CUT GLASS AND MACHINE-MADE GLASS

The beautiful cut and engraved glass that you see is first blown thick. Then on grindstones or copper wheels of different sizes the grooves and markings are cut according to a pattern which has been decided upon, after which the articles are polished. Skillful workmen are needed for these processes. Much pressed glass is made to imitate cut glass, but does not have the sparkle of the real article.

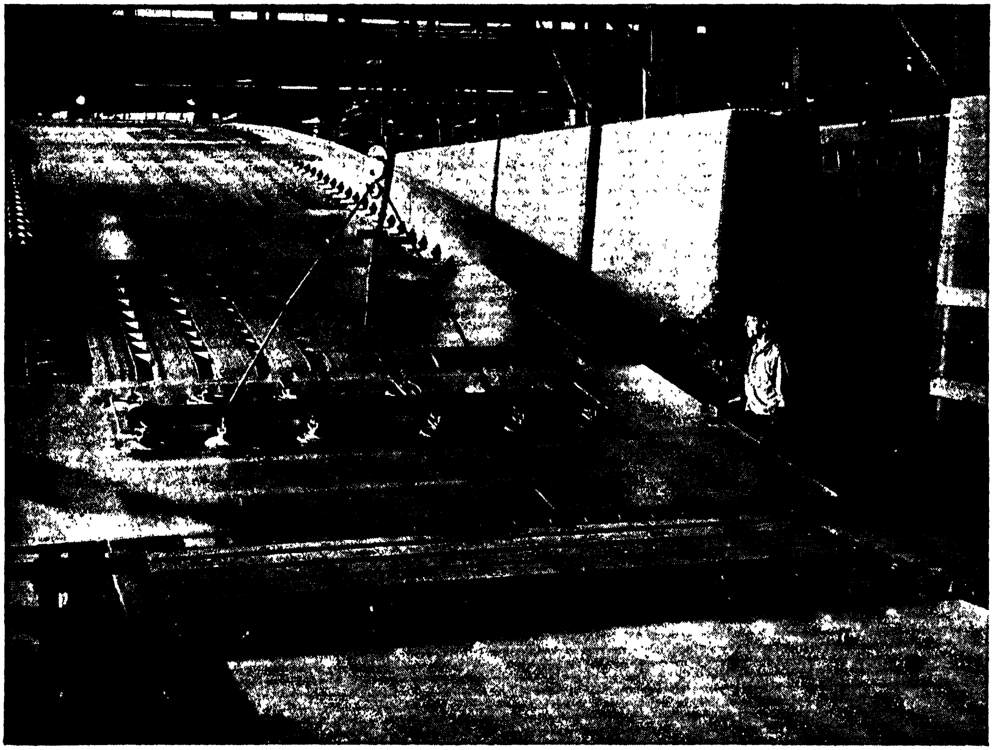
In contrast to the hand methods of making fine glassware is the manufacture of items of more general use by automatic and semi-automatic processes. A modern bulb-blowing machine produces from 250 to 300 electric light bulbs a minute. In 1879 it took a group of men an entire day to produce 165 satisfactory lamp bulbs for the great inventor, Thomas A. Edison!

THE WONDERFUL MACHINE THAT MAKES BOTTLES

One of the most remarkable machines in the glass industry is the bottle-making machine. On the next page we show you a picture of such a machine which can turn out more than 100,000 bottles in twenty-four hours. Gobs of molten glass enter the machine at the back. By going through a number of operations, the glass is made into bottles or jars, which come out at the front of the machine. Then there is the tubing tower over 200 feet high, which draws long tubes of glass out of a red hot ball of glass to make glass tubing for the thermometers that doctors use. These tubes can be cut to any size, and are very accurate in outside diameter and bore.

By means of a small lathe in which is fitted a little copper wheel, the expert engraves beautiful and delicate designs on the surface of the glass.

Plate glass, in great sheets for shop windows or smaller ones for tops of tables and desks, is made by pouring molten glass on a cast-iron table where it is rolled flat by an immense iron roller. Then the sheet, while still hot, is passed to the "lehr," or chambers of graded temperatures, where the glass slowly cools. After the sheet is removed from the lehr, it is ground and polished to remove all surface roughness and insure uniform flatness. This is a long process, since several different grades of sand, emery and rouge are used, and each on a different machine. When one side of the glass has been completley ground and polished, the sheet must be reversed and the entire process repeated on the other side. Another method of making plate glass is that of pouring molten glass between two enormous water-cooled rollers which are set to give it the thickness desired, after which it is ground and polished.



Enormous sheets of plate glass being moved by conveyor belts to the next processes which are grinding and polishing. Plate glass is used in many ways, but principally for shop windows, table tops, mirrors and shelves. Furniture is also being made of plate glass but it is, as yet, more or less, an experiment.

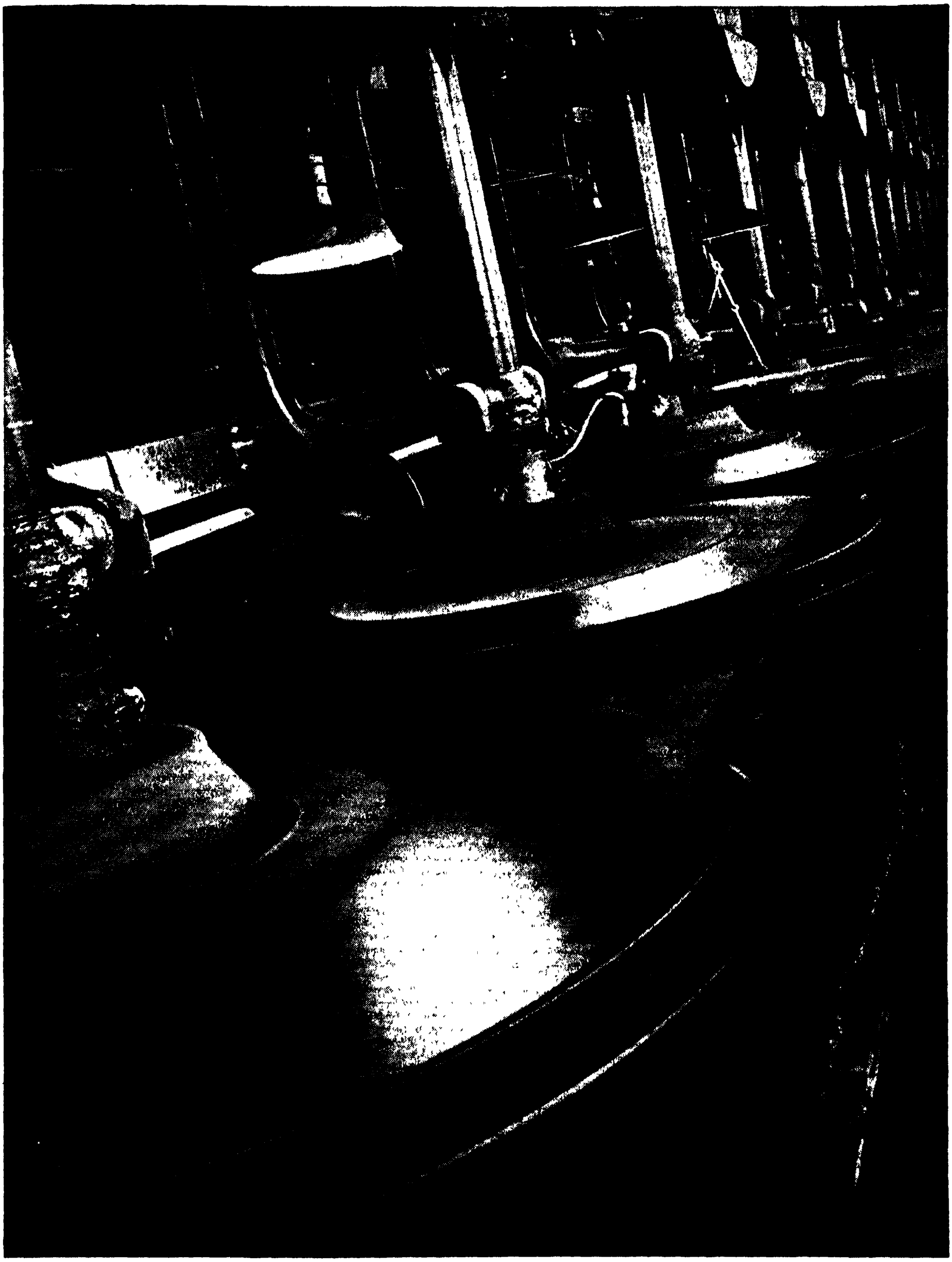
Common window glass generally is made to-day by the "drawing" method. An iron bar, called the "bait," is lowered into a tank of molten glass. The bar is then lifted horizontally, drawing molten glass with it, and is passed over a large roller that spreads the glass out into a thin sheet. There are several variations of this process, such as passing the glass between asbestos-covered rollers while it is still being drawn vertically. When the sheet emerges from the machine, it is passed through an annealing lehr and then cleaned and cut to size. In a Ford factory where glass is made for automobile windows a new process, called the continuous process, has been developed. By this method, glass sheets are not made one by one but continuously.

Most automobiles made to-day in this country must use for their windshields and windows a kind of glass called "safety," or non-shatterable glass. In fact, in most sections, laws have been passed requiring its use, for it has been estimated that two out of every three injuries in automobile driving were caused by broken glass.

How does glass, which is so brittle that it breaks when we drop it, become "safety" glass? It is made in this way: A thin sheet of transparent gummy substance, or plastic, as it is called, is put between two plates of glass like a sandwich, and when heat and pressure are applied, it becomes one plate. Although this glass will crack, it will not shatter as the loose bits of glass adhere to the gummy plastic.

Another form of window glass is wire-glass which is useful to prevent the spread of fire. Wire netting is placed in the molten

POLISHING PLATE GLASS



One method of making plate glass is to pour the molten glass on a huge table, after which a heavy roller is run back and forth over it until the table is covered with a sheet of glass. Another method is to pass the molten glass between large cooled rollers, which have been set to make the glass the desired thickness. In either case, the sheet must be ground and polished. This picture shows a long line of mammoth polishing wheels in one of the large factories busily whirling on the surface of the glass, after which the glass will be smooth. Each side of the glass is given the same treatment, then it is ready for cutting into different sizes.

Photographs on pages 6748, 6749, and 6752, courtesy, Pittsburgh Plate Glass Co.

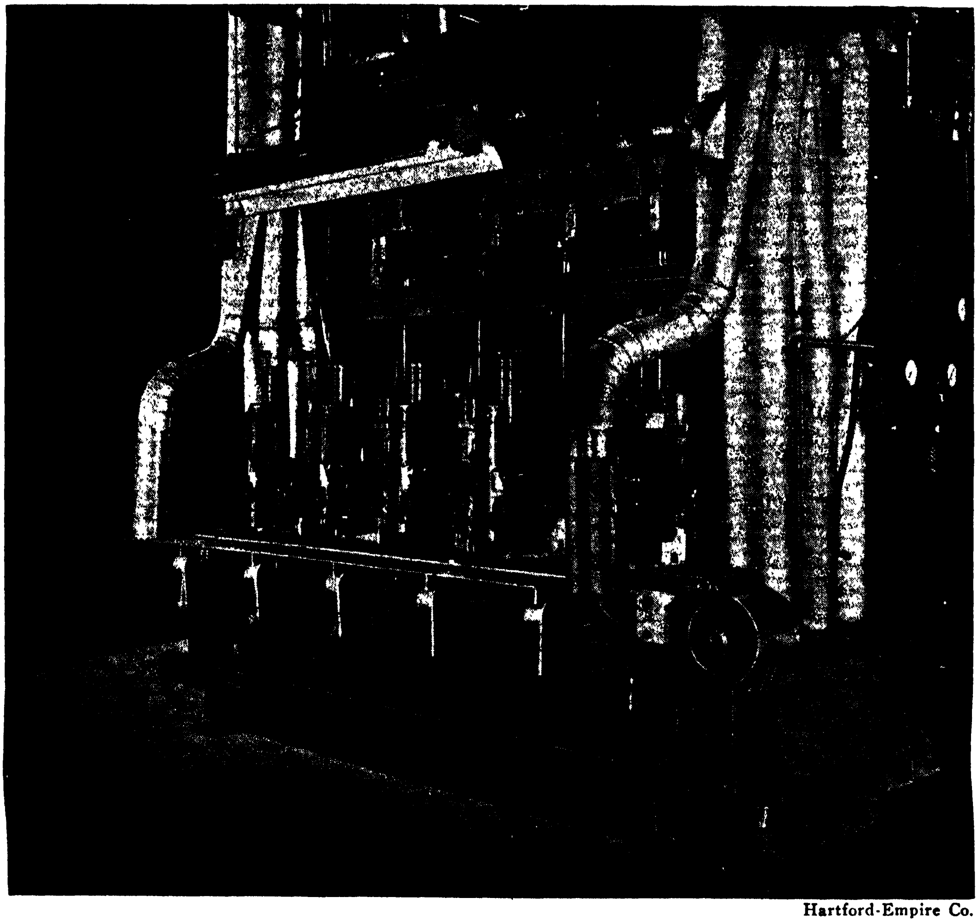
glass and while it is still hot, it is rolled to the desired thickness. The netting keeps the panes from falling out when they are struck or when the heat becomes too great.

We might also speak of another kind of glass that is made for office partitions and is used also in bathroom windows. It is somewhat thicker than window glass and all over its surface small patterns are pressed, so that it is not possible to see through it, yet a certain amount of light gets in.

Light that comes through ordinary window glass does not contain ultraviolet rays, but a special glass is made that lets in these valuable rays and gives those who have to stay indoors all the benefits usually obtained from outdoor sunshine. This kind of glass is used often in hospitals and sanatoriums and also in private homes.

Glass having a borosilicate compound in its formula has many uses. This brand of glassware is tougher and can withstand heat changes better than ordinary glass; it also is superior for electrical insulation. These glasses were first used for laboratory and pharmaceutical equipment, but now are used to make such diverse things as oven- and flameware for cooking, glass insulators for high-tension transmission lines, and the giant 200-inch telescope disc—the largest single piece of glass ever cast—for the Palomar Mountain observatory in California.

Walls of glass blocks have many advantages. They allow outside daylight to pass through, yet you can not see through them—they are translucent, but not transparent. They also are strong, and are better heat insulators than many other wall materials.

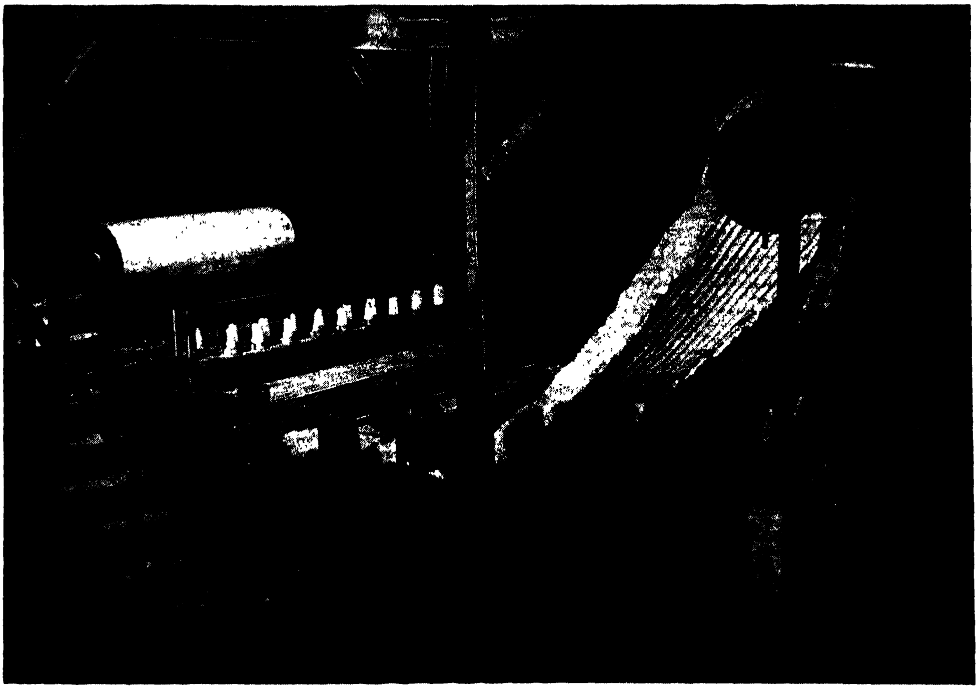


Hartford-Empire Co.

Each of the five sections of this machine can make up to twenty-one pieces of glassware a minute. Gobs of molten glass drop into a mold at the back of each section; then the ware is transferred to a finishing mold at front.

NEW USES FOR AN AGE-OLD PRODUCT

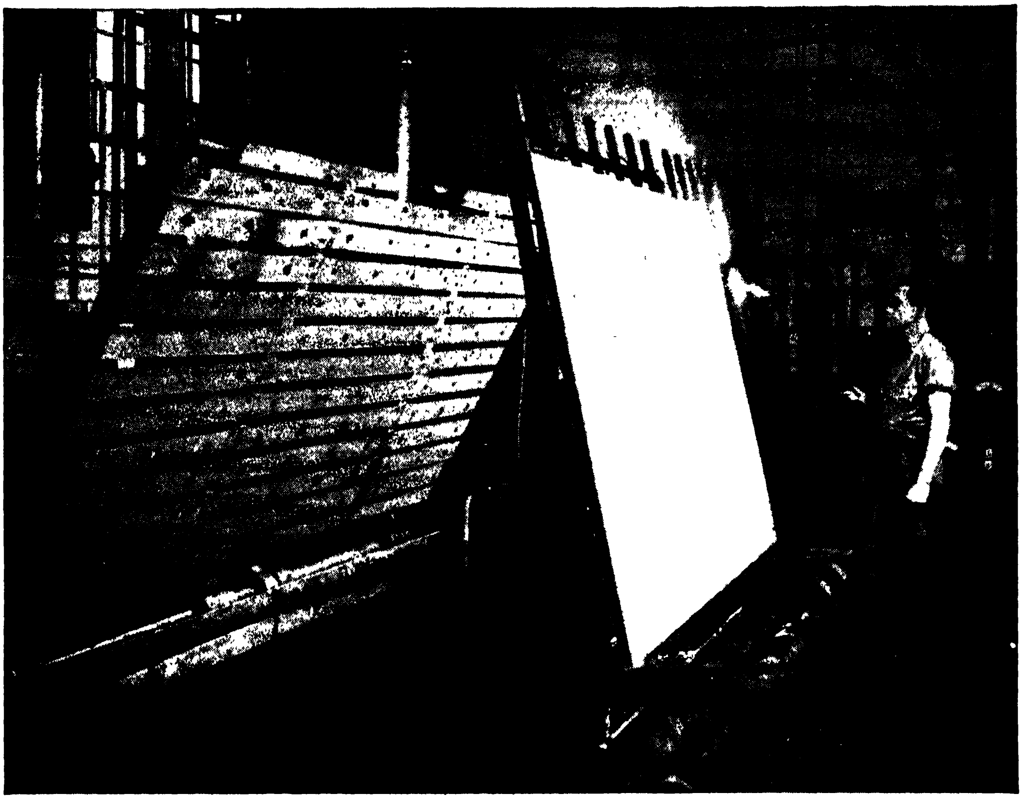
Glass bricks for the outside walls of buildings and glass tiling, made in a variety of colors for the walls of kitchens and bathrooms, are only two of the many new uses for glass. Furniture and fabrics, too, are made of glass.



Although this looks like cotton batting, it is really glass "wool," which is used for insulating purposes. The tiny glass fibres, of which it is made, can be made as small as one-fifteenth of the diameter of a human hair.

than walls made from ordinary building materials. For this reason they lend themselves well to modern air conditioning during the summer and economical heating during the winter.

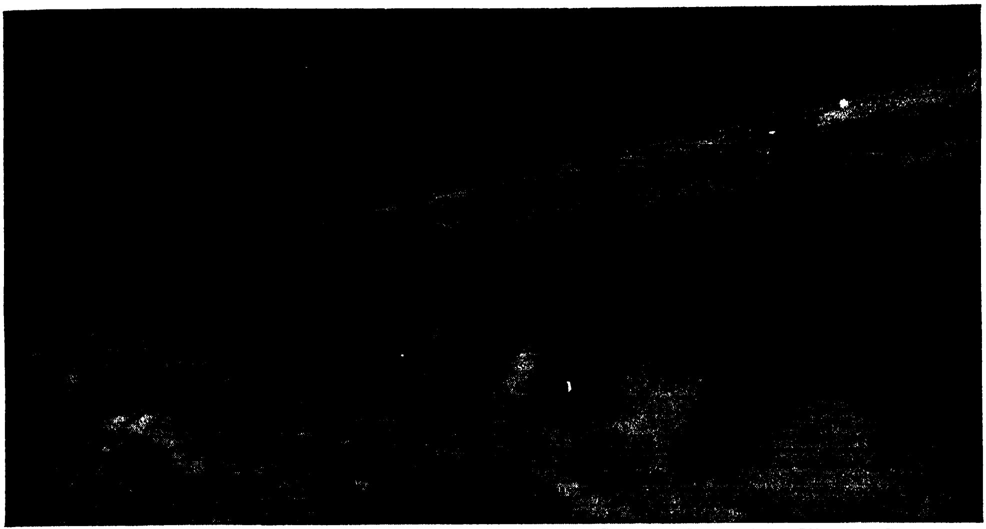
Another use for glass in the building field is fibrous glass for between-the-walls "thermal" or heat insulation. Glass in this form looks like cotton or wool—it is drawn into fine strands by a special process, and can be made as fine as one-fifteenth the thickness of human hair. When this fibrous glass is made for building insulation, it is formed into bats of convenient sizes, and these are placed between the walls. For houses that are already built, the glass is made into little nodules, or lumps, and these are blown between the walls. Fibrous glass also has other uses. It can be woven into cloth and used as insulating tape to cover electric wires, or it can be made into filters for air conditioning systems, or used as filters in chemical laboratories. It also is utilized as an agricultural mulch to take the place of hay or manure in protecting tender plants from winter cold. The advantages of fibrous glass over organic materials are many. It will not burn, decay, absorb moisture or settle, and vermin cannot eat it, so it is more than likely that in the future fibrous glass will be turned to many practical uses that at present are unheard of.



At one time, plates of metal were used as mirrors. When glass was used, it was given a coat of mercury and tin, but the process was slow and expensive. Now the glass is sprayed with a solution of nitrate of silver.

The beauties of glass are too numerous to mention. You have seen wonderful vases, plates and goblets in shop windows. Many of these pieces have marvelous colors. Some of these colors are obtained by mixing the coloring in the pot, some by mixing two or more different batches of glass, and some by applying coloring matter of enamel after the vase has been shaped and then applying heat. To tell of all these gorgeous colors and the methods used in obtaining them in glass would require a book.

Article prepared with the assistance of Corning Glass Works.



Courtesy, Oregon State Highway Commission

Main spillway of the Bonneville Dam, on the Columbia River 42 miles east of Portland, Oregon.

WATER POWER OF THE WORLD

THE first inhabitants upon this earth performed all their tasks by their own unaided strength. From a very early day, however, men tried to find substitutes for what we might call man power. They harnessed the easily tamed animals, such as the horse and the ox; they developed mechanical devices, like the lever and the roller. They also began—timidly and not very effectively at first—to harness the strength of a mighty giant, who could perform the hardest tasks with the greatest of ease. This giant was the power of flowing water—the flowing water of broad rivers, of twisting rapids, of thundering waterfalls.

Here is a natural source of energy that is abundantly supplied at all times because the sun is hot and the pull of gravity is powerful! The heat of the sun, you see, causes water to evaporate from the seas; this evaporated moisture is carried aloft as vapor. Some of this vapor, rising ever higher, cools and forms clouds. When cooling continues after the formation of clouds, the tiny drops of water of which the cloud is composed run together in larger drops.

Yielding to the force of gravity, these drops fall to the ground as rain or—if the air is cold enough—as snow and hail. More of this moisture (rain, snow, hail) falls upon the earth's surface than can be absorbed by it. The excess moisture remains upon the surface of the earth and we have lakes, rivers, springs, waterfalls. Through the pull of gravity, surface water makes its way to the seas. Again the heat of the sun causes vapor to rise to the upper air and the process that we have just described is repeated. It will continue as long as the earth endures.

When was the power of flowing water first used to perform work? We know that from very early times men set up water wheels, provided with paddles and moving on a horizontal axis (that is, one parallel with the ground). These water wheels were built over streams in such a way that as the current struck the flat blades it would turn the wheel. In China to-day are found great water wheels but little changed from those used several thousand years ago. The Egyptians had them; so did the old Romans. These water wheels were used to grind corn and, later, to saw logs and do other work.

The first water wheels, as we have seen, were moved by the current of flowing rivers. Later wheels were designed to utilize the energy of falling water. They differed but little from the earlier water wheels; often, however, cup-like buckets (or vanes, as they were sometimes called) were used instead

AN UNTAMED GIANT OF THE NORTH

Courtesy, Commissioner of National Parks

Falls on the Snake Indian River, in Canada's great Jasper National Park. If it were harnessed to a water wheel, this foaming cataract could supply abundant electric power to communities many miles away.

of paddles. Throughout the stormy middle ages and up to modern times these cumbersome water wheels were used.

Toward the middle of the eighteenth century water wheels began to provide power for the busy machines of the factories that sprang up everywhere. Yet, until the water wheel could be improved, it could not serve this purpose very effectively, for it was an imperfect means of producing power.

There were three types of water wheels in use: the overshot, the breast and the undershot. The water reached the blades of the overshot wheel at or near its highest point and caused the wheel to rotate in the direction of the current. The water was applied to the breast wheel slightly below the level of the wheel's axis; in the case of the undershot wheel the water struck the blades considerably below the axis.

All these wheels were very inefficient. Only a small part of the wheel received the push of the water at any one time. Furthermore, when buckets were used instead of paddles, each bucket, after being struck by the water, would continue to carry some of the water with it as it went around the wheel. As the water that was retained in the bucket reached the rising part of the wheel, it would tend to hold it back.

INVENTION OF THE TURBINE

In the thirties of the last century a Frenchman called Fourneyron invented a new sort of water wheel. Perfected by a number of other inventors—among them the Americans Samuel B. Howd, James B. Howard and John B. McCormick—this new wheel, called the turbine, proved itself greatly superior to the old type of water wheel. It is very widely used at the present time.

The water wheels that we described above —overshot, breast and undershot—were all placed upon a horizontal axis so that the wheels themselves were upright. In the case of the turbine the wheel is set upon its side and it turns upon a vertical or upright axis. Again, in the case of the older type of water wheel, the water struck only one paddle or bucket at a time. In the turbine, by an ingenious arrangement, the water strikes all the buckets at the same time. Let us see how this is done.

The turning wheel is set inside an immovable outer casing, a sort of circular channel in which the water flows continuously. All around the inner side of this channel there are a number of openings, called guide vanes, that let the water escape from the casing and strike the buckets of the wheel. There are as many guide vanes as there are buckets. As each bucket passes by a corresponding guide vane it receives the full energy of the incoming stream of water; furthermore each bucket receives its push from the water at the same time as the rest of the buckets. Finally, having performed its task of pushing the wheel, the water flows down from the wheel through an opening and is carried off. In some turbines the casing is set within the water wheel but the principle involved is the same.

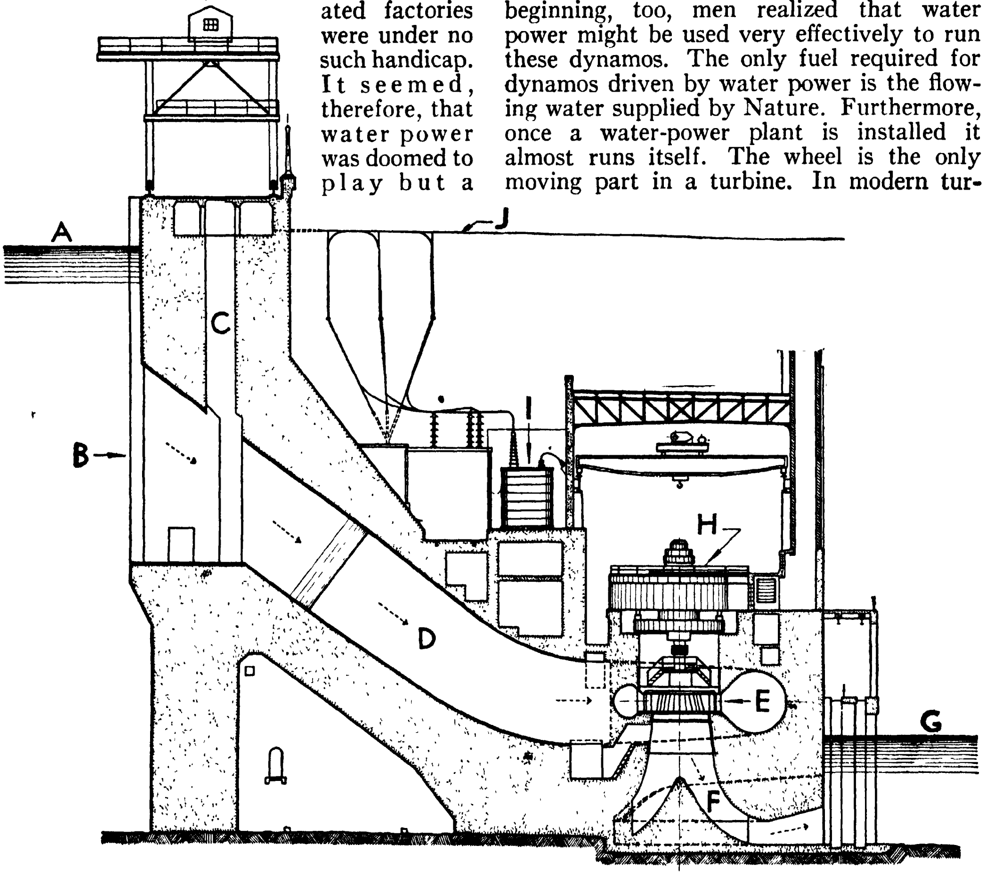
The old type of water wheel could utilize only a small head of water (a head of water represents the height of the water flow, measured from the water wheel to the water source). Water falling from too great a height would have damaged the fragile wheel. In the case of the turbine, as we have seen, the water is not applied to the blades of the wheel directly, but to the strong casing built around the wheel. This means that a turbine can utilize a much higher head of water than the old-fashioned water wheel.

THE EFFICIENT PELTON WHEEL

In the eighties of the nineteenth century an engineer called Pelton developed a water wheel that could utilize high heads of water when the volume of water was not great. This wheel, called the Pelton wheel, rotates on a horizontal axis like the old-fashioned water wheel. To the wheel itself are bolted a series of twin cup-shaped buckets, set side by side and separated only by a sharp dividing ridge.

The old type of water wheel was set in the stream that furnished water power. The water that is to strike the Pelton wheel is imprisoned in a pipe at the end of which is a nozzle (or several nozzles). The jet of water from this is directed at the dividing ridge between the two rows of buckets. Part of the water strikes one of the twin buckets; the rest of the water strikes the other. As soon as the water has given a push to each of these buckets it is thrown off. The Pelton wheel is sometimes called the impulse turbine because it operates by means of a series of impulses or pushes directed by the water against the wheel.

With the development of the turbine and later of the Pelton wheel, a far greater supply of power was available for the use of factories at water-power sites. Yet, as the nineteenth century advanced, water power came to be increasingly neglected. For one thing, the development of the steam engine assured manufacturers of a steady and reliable source of energy which could be applied almost anywhere. After all, plants relying on water power had to be established near water-power sites. These sites might be at a considerable distance from the raw material which the plants used and from the markets which they supplied. Steam-operated factories were under no such handicap. It seemed, therefore, that water power was doomed to play but a minor part in industrial development.



Courtesy, Shawinigan Water and Power Co.

Diagram of a water power development. The powerhouse and dam form part of the same unit. The dotted arrows in the diagram indicate the direction of the water flow. A. Head race—water backed up behind dam. B. Trash racks —sifting devices to keep ice and rubbish from turbine. C. Emergency gate, to cut off flow of water as necessary. D. Penstock—tube through which water flows to turbine. E. Turbine. F. Draft tube, through which water flows from turbine. G. Tail race—channel which directs water away from turbine. H. Electric generator. I. Transformer which increases voltage of the current generated by H. J. Transmission line leading from powerhouse.

The commercial application of electricity, which began with the last quarter of the nineteenth century, changed all this. Electricity was first used commercially for lighting purposes. Then it was used to move vehicles, to run the machines of factories, to whirl the blades of fans, to provide heat and to do a thousand other things besides. The generation of electricity became one of the most important of industrial activities.

Of course the great dynamos that produce electricity can be made to turn by means of steam engines. In fact, from the very beginning of the electrical industry to the present day steam-driven dynamos have played a highly important role in the generation of electricity. But from the very beginning, too, men realized that water power might be used very effectively to run these dynamos. The only fuel required for dynamos driven by water power is the flowing water supplied by Nature. Furthermore, once a water-power plant is installed it almost runs itself. The wheel is the only moving part in a turbine. In modern turbines these wheels are self-lubricating; that is, oil is applied automatically to the working parts of the wheel as it turns.

Again, through the use of transmission wires electricity can be sent over considerable distances. The electricity generated at a water-power site can light the streets or drive the factory machines of communities several hundred miles away. It can serve an area of as much as 200,000 square miles—

TWO GREAT WATER POWER DEVELOPMENTS

Dam in the Rio das Lages water power development, about 50 miles from Rio de Janeiro, Brazil. The dam is built in a curve so that it may resist more effectively the great pressure of the water behind it.

Courtesy, Finnish Travel Information Bureau

Power station at Imatra, Finland. This great development, built by the State in 1921-29 on the east bank of the Imatra Rapids, supplies the whole of Southern Finland, as far as Helsinki, with electricity.

Courtesy, Royal Canadian Air Force

Water power development at Paugan Falls, near Low, Quebec, about 36 miles above the mouth of the Gatineau River. This plant has a capacity of 272,000 horse power. Current is sent over transmission wires some 230 miles to the great city of Toronto. This is one of the longest transmission lines in the world.

Courtesy, Canadian Pacific Railway

Power plant at Magog in the Province of Quebec, Canada. Note the transmission lines that carry the current from the powerhouse. Before being sent out over these lines the voltage is increased greatly by a transformer. Below the powerhouse is seen the tail race, a channel that carries off the water from the turbines.

more than three times the combined area of all the New England states.

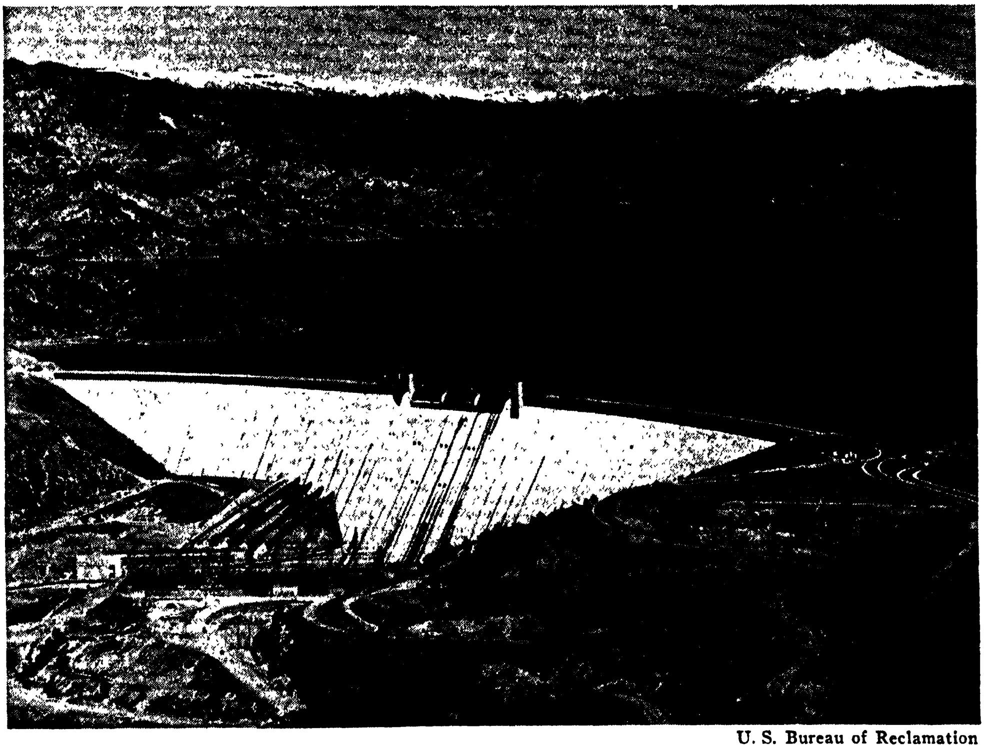
The eighties of the last century saw the setting up of the first hydroelectric stations (*hydroelectric* refers to electricity produced by water power—*hydro* means water in Greek). Soon these stations were multiplied in many different countries. A new era had dawned for white coal, as water power was called, from the foaming white surface of the swift water used.

There are still some horizontal water wheels and turbines that do direct work—that is, that are directly connected with machines which perform such work as grinding corn or sawing boards. In the great majority of cases, however, water power is now harnessed in order to generate electricity.

Let us examine a modern hydroelectric plant in which power is supplied by turbines. First there is a large dam which stores up water in order to supply a steady and uninterrupted flow of water to the turbines. This dam is provided with head gates in order to regulate the flow of water. It also has trash racks—sifting devices, which keep ice and rubbish from the delicate mechanism of the turbines. The water flows into the outer casing of each turbine through a huge steel tube, called a penstock; the flow of water in the penstock is controlled by valves. After the water has set the turbine wheel revolving, it passes through the turbine into a pipe, called a draft tube, and from that into an open channel, called a tail race. This channel carries the water back to its natural stream.

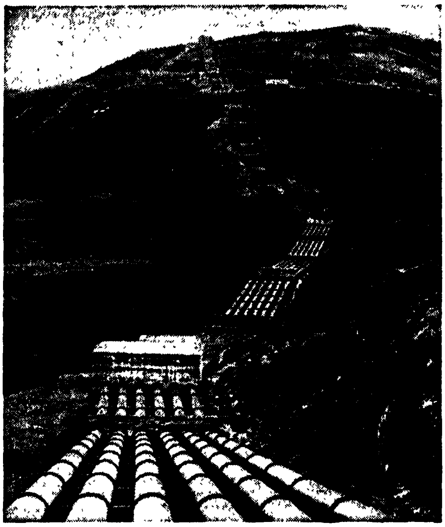
As the turbine revolves, the shaft at its centre is also rotated and this turns the dynamos which generate electricity. The electric current is sent out upon transmission wires set upon high steel towers. On page 6756 we see a diagram of a typical hydroelectric development.

In the plant that we have just described, the dam and powerhouse are really two parts of a single unit. The dam may also serve to store up water for irrigation purposes (see page 2548). This type of plant has become very common in late years. There are, however, many other types of hydroelectric developments. In some cases there is no dam.



U. S. Bureau of Reclamation

Shasta Dam lies amid mountains on the Sacramento River, and is the main part of the Central Valley Project in California. The enormous concrete structure is 602 feet high, with a crest length of 3,500 feet.



When a river is harnessed it may be imprisoned in pipes and brought to the turbines, as it is done at Kinlochleven, Argyllshire.

The water is carried from its source to the turbine by means of a flume (a long open box-like structure of wood or metal) or along a canal. In such cases the water head is generally very low. In other cases, where the head of water is very high and the volume of water is not great, the water may be carried down a steep slope in one or more long pipes to a powerhouse set at the foot of the slope. Pelton wheels are often used for such developments.

The electricity supplied by water power, as we have seen, serves many different purposes. Among other things it is often used in the manufacture of certain substances, such as nitrates and aluminum, in the production of which a great amount of electric current must be used. Hydroelectric power supplies current in great quantity and at comparatively low cost for the manufacture of nitrates and aluminum and other substances, such as carborundum, used for grinding purposes, and caustic soda, used in making soap and various chemicals.

Few indeed are the civilized nations that have not more or less extensive hydroelectric developments. Norway and Sweden have developed abundant and cheap power from their numerous waterfalls. The rapids of Finland provide excellent sites for water power stations. The most famous of these is the large power station at the Imatra Rapids; it supplies the whole of Southern Finland with electricity. In Switzerland, Germany, France, Italy and Spain progress in the development of water power has been rapid. In Asia Japan has made excellent use of her available water power resources; while China has developed but little of her potential water power (that is, water power that can be used if suitable plants are set up). Africa is the richest of the continents in water power possibilities, though little has been done to develop them. Brazil has more hydroelectric plants than any other South American nation.

WHITE COAL IN THE UNITED STATES

Nowhere has water-power development made such rapid progress as in the United States, which has already developed over 18,000,000 horse power of the more than 40,000,000 available in potential water power. The great hydroelectric plant on the American side of Niagara Falls supplies electricity to places as far as 150 miles away. Other great hydroelectric stations in the East are the Harriman plant on the Deerfield River, the Fifteen-Mile Falls plant on the Connecticut River and the Conowingo station on the Susquehanna River in Maryland.

The Tennessee Valley Authority project provides electricity to consumers in Kentucky, Tennessee, Virginia, North Carolina and other southern states from such hydroelectric stations as Wilson Dam, Norris Dam and Wheeler Dam. The power plant at Keokuk, Iowa, utilizes the waters of the Des Moines Rapids.

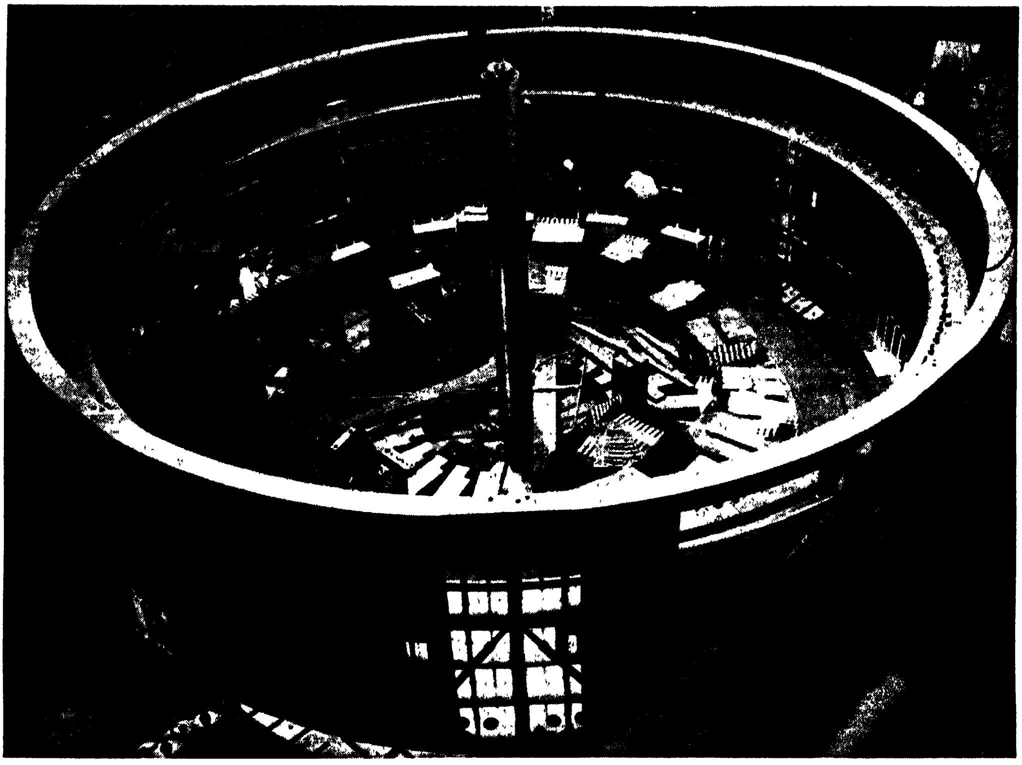
In the Far West the electricity generated by the Pit River plants in California supplies communities as far away as San Francisco (220 miles distant). Another fine hydroelectric development is the plant at Snoqualmie Falls in Washington, supplying a large district in the Northwest. Many great dams of the Far West combine water storage for irrigation purposes with the production of electricity. Among these are Hoover Dam in Arizona, Grand Coulee Dam in Washington, Shasta Dam in California and Fort Peck Dam in Montana. We have already described Hoover Dam on page 2550. The Grand Coulee Dam, on the upper Columbia River, produces up to 2,500,000 horsepower, more than any other plant in the world. Water stored in its reservoir will make more than a million acres of arid land fruitful.

For a considerable period the development of water-power resources was left to private corporations, with only a limited degree of regulation by the States and the Federal government. In 1920 the latter assumed a most important role in power development with the passage of the Federal Water Power Act of 1920. This created a Federal Power Commission, entrusted with the licensing of water-power developments in navigable streams and on public lands and reservations. Licenses were to be limited to 50 years. Since 1920 the Federal government has taken an ever increasing part in developing the power resources of the United States. Some of the greatest hydroelectric plants erected within recent years—Boulder Dam, Grand Coulee Dam, the dams of the Tennessee Valley Authority, among others, have been built with government funds.

Canada has also made great progress in developing her water-power resources; she has already developed over 10,250,000 horse power out of a total of about 50,000,000 potential horse power. Electricity generated by hydroelectric stations supplies most of the power for Canada's growing industries. The greatest Canadian hydroelectric plant is the Queens-Chippewa development at Niagara Falls. Other mighty water power developments include the hydroelectric plant at Shawinigan Falls, Quebec, Smoky Falls development on the Mattagam River, Ontario and the Grand Falls development on the St. John River, New Brunswick. The provincial parliaments control the water power in the provinces; the Canadian parliament, that in the territories and public lands.

The world supply of coal and oil is limited; the supply of white coal is unlimited and will continue to be unlimited while the sun shines and the clouds form and the rain falls and the rivers run off to the sea. For this reason some people have come to think of white coal as *the* fuel of the future. Men have harnessed waterfalls and rapids and rivers. They have even tried to harness the tides of the sea by storing high-tide water in reservoirs and dropping it upon turbines. Coal and oil will continue to be used for many years, perhaps for many centuries; yet it seems certain that water power will play a more and more important role in performing the tasks of the world.

THE NEXT STORY OF FAMILIAR THINGS IS ON PAGE 6815.

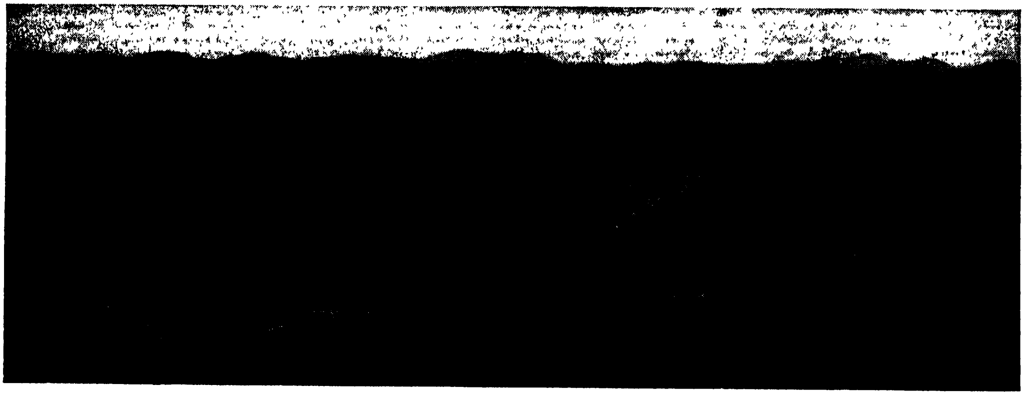


Courtesy Westinghouse

This picture shows construction on a mighty water wheel generator for the Grand Coulee Dam in the State of Washington. The completed generator contains over 700 tons of steel and almost 100 miles of copper wire.

Courtesy, Stone and Webster Engineering Corporation

Inside a powerhouse. This view shows seven generators, each driven by a turbine. Compare the size of the generator in the foreground with that of the man standing beside it! A generator of this type can deliver 50,000 horse power and more; yet it almost runs itself, requiring little attention.



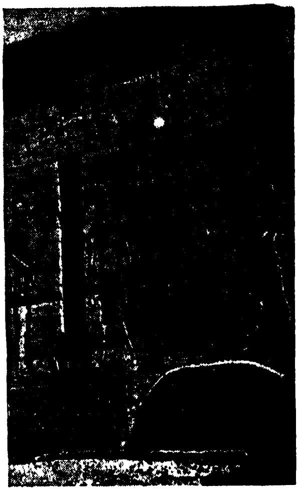
The transmission line that carries the electric current from the Rio das Lages water power development to the great city of Rio de Janeiro in Brazil. This transmission line extends a distance of 50 miles. Brazil has developed her water power resources more highly than any other South American country.

Philip D. Gendreau, N. Y.

This Roman relic, now in the Metropolitan Museum of Art, shows Cybele, the mother of the gods, in her chariot.

L. Green from Gendreau, N. Y.

A carved stone figure found in the ruins of a Pre-Incan civilization in South America.



Gramstorff Bros., Inc. Malden, Mass.

One of the pylons or gateway towers to the Temple of Isis in Egypt. See how clear the carvings are!

DIGGING UP THE PAST

LESS than half a century before Columbus discovered America, another world, the world of ancient times, was discovered by Europe. It happened in this way. After the barbarians overran the Roman Empire in the West, Constantinople became the chief city inhabited by Greeks. They had preserved the memory of their glorious past, but there was little contact between Constantinople and other parts of Europe until, in 1453, the Turks captured Constantinople. Greeks then fled westward by the thousands.

Scholars among the fugitives settled in the large cities of Italy, and many became teachers and secretaries to families of wealth. To their patrons and employers they brought knowledge of the days of classic glory in Greece and Italy, almost two thousand years gone by. They brought with them books and manuscripts and objects of art. They fired the imagination with a love of the old.

In a few years Europe was aflame with a fierce zeal to capture again the knowledge that had been lost. Italians began to dig for buried treasure, hoping to discover, under the dust of centuries in their own yards, statues of great beauty or coins of value; and many treasures were found, in the earth and in old storehouses and forgotten corners. This period marks the beginning of man's interest in digging up the past. For centuries, however, this interest was primarily for the sake of finding things of worth or beauty.

In recent times, digging has assumed a very different nature. Scholars are fired with the hope of learning what the world was like in the distant past. These diggers are called archaeologists, a word made up of the Greek words for olden times and for students. In half a hundred places these students of olden times are plunging their spades into deserts or mountain sides, dredging streams and lakes, and flying over desolate wastes looking for cities thousands of years old, and finding them, too!

When Columbus discovered America, it was a wonderful experience for men with imagination to see the earth-horizon widening out. It is just as wonderful to see the time-horizon being pushed back toward the beginning of civilization.

One of the most interesting of the modern archaeologists was Heinrich Schliemann, who began life as a poor boy, in Germany. As a child he loved classical literature, especially the stories of Homer, and it was his dream to discover whether or not Homer's beautiful city of Troy ever really existed. Schliemann became, through his own industry, a very wealthy man, and when he was forty-six years old he moved to Greece. He knew, as everyone interested in archaeology knows, that ancient cities are likely to be found buried under modern ones. Sometimes ruins of a dozen cities, belonging to as many different eras, lie one on top of the other, like a layer cake. Schliemann examined one city after another along the coast of Asia Minor, and decided that the town of Hissarlik, just south of the Dardanelles strait, near the island of Tenedos, must be the site of ancient Troy. Digging far below the foundations of the modern town, he uncovered nine ancient towns, built one above the other! One of these, by its buried relics, was found to be the Ilium, or Troy, of Homer.

WHY EGYPTIAN TOMBS HAVE PROVED A RICH SOURCE OF ARCHAEOLOGICAL TREASURE

Archaeologists have long been busy in Egypt; and they have been fortunate in their finds, partly because the ancient Egyptians piously buried many kinds of records and relics with their dead, partly because the climate preserved for centuries objects which in other regions would have decayed.

Although archaeologists still can not be sure about some of the dates, they have been able to put together enough pieces of history's fascinating jigsaw puzzle to gain a picture of what Egypt was like as far back as 7,000 years ago, and they even know certain facts about earlier, or prehistoric, times!

MAKING A TIMETABLE FROM ANCIENT POTTERY AND COINS

How is it possible to fit articles dug up from the earth into a proper historical timetable? This is really comparatively easy. A young, poor nation, with a simple government and plain mode of life will produce crude tools and rough pottery and basketry, decorated, if at all, with feeble skill. As time passes, tools will be more ingenious, and increased skill in making and decorating pottery will be shown. Coins will be found, carved with a ruler's picture and name, or the picture of a god. Later still, better coins will show another king, or another god. Rock carvings in the tombs will be more skillful. The method of building will disclose greater knowledge. Marble, alabaster, painting, gilding, precious stones and jeweler's work will tell their story of development.

Gradually, as grave after grave gives up its treasure, the history of the country is laid bare. The work of the excavator is aided, of course, by the scholar who translates the rolls of papyri or the inscriptions found.

In about the year 1360 B.C., a young noble in the Egyptian city of Tel el-Amarna was married to the king's third daughter. Unexpectedly, the young man succeeded to the throne, moved his capital to Thebes and, in honor of the Theban sun god, Amen, changed his own name to Tutankhamen; but he died young, leaving his bride a widow. Fearful that her enemies would take the throne away from her, she wrote to the powerful king of the Hittites: "My husband is dead. They say you have many sons. Send me one and I will make him king." Manuscripts exist telling that a Hittite prince was sent in answer to her plea.

She must have loved her husband Tutankhamen very dearly, however, for she gave him a magnificent burial, and hid his tomb so cleverly that it was not found until 1922. The richness of that find almost beggars description.

KING TUTANKHAMEN'S TOMB CONSISTED OF FOUR ROOMS FULL OF FURNISHINGS

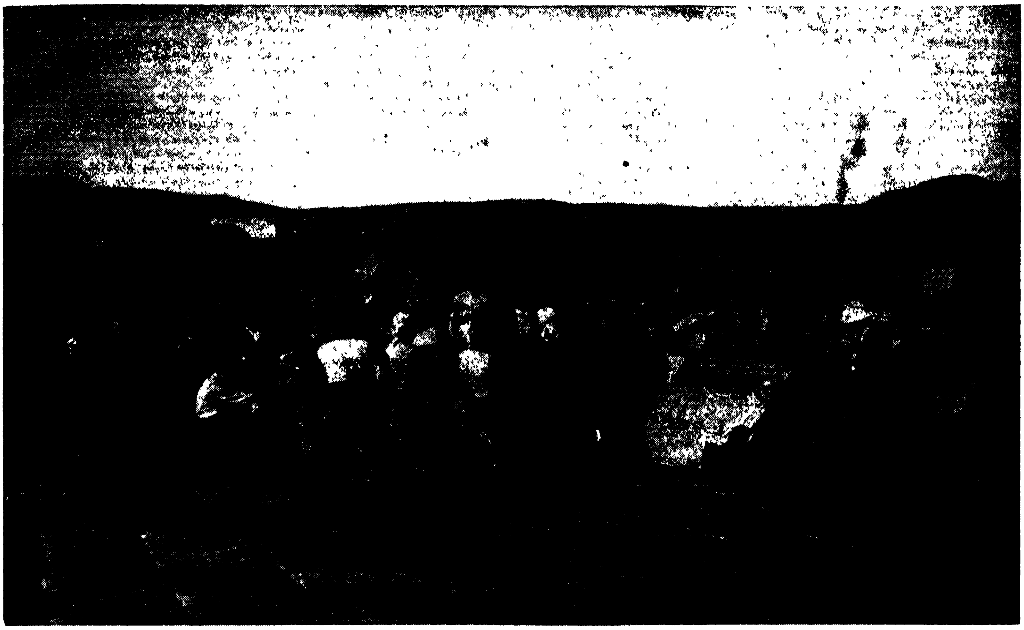
There he lay, the boy king, wrapped in layer after layer of linen. Between each two layers were gold and jeweled necklaces, bracelets, collars, pectorals (breastplates), anklets and other ornaments. His mummy was in a nest of coffins or shrines, contained in a pink granite sarcophagus, and this was lying in a great gilt shrine as large as a good-sized room. The four rooms of the tomb were full of furniture, household implements, agricultural tools, objects of art, gold and jeweled ornaments, statuary, painting, written records, and figurines dressed as farmers, boatmen and other workers.

A region which fascinates archaeologists fully as much as Egypt is the Near East, the section of western Asia containing Palestine, Syria and Mesopotamia. There have been years when fifty scientific expeditions have been at work in that relatively small area, digging from under their blankets of earth buried cities centuries old. Do you remember the story of Jericho, in the Bible, the city whose walls fell down when the Jews marched around it? Jericho has been found and it has been determined that the city fell in about 1400 B.C.

EVIDENCE OF KING SOLOMON'S SPLENDID STABLES WERE UNEARTHED IN ASIA MINOR

Solomon's fine Egyptian horses were famous in his day. Doctor James Breasted and his fellow-workers from the University of Chicago unearthed one of King Solomon's magnificent stables. There still remain stone hitching posts, with holes for the halters. Mangers stand between each pair of posts. There are stalls for more than 250 horses, rooms for the grooms, grounds for exercising the steeds and for exhibition riding, and, actually, a deep silo where feed was stored.

In 1928, in lower Mesopotamia there was found a thick layer of river deposit showing



Courtesy, University of Michigan

The archaeologist (in sun helmet) is directing a party of native laborers who are carefully removing a heavy stone with carved inscriptions from an excavation in the Near East. Universities sponsor many such expeditions.

that a flood of remarkable proportions overran the land about 5400 B.C. This is almost certainly the flood described in the Old Testament.

The Hittites were a powerful, warlike people who overran Asia Minor and established an empire ending about 717 B.C. In the ruins of two great Hittite cities were found hundreds of broken tablets inscribed with cuneiform writing. They have been pieced together and now form a valuable library of information dated about 1200 B.C. Fragments of dictionaries in three languages were found. Some of the inscriptions still remain a fascinating puzzle. Another interesting Hittite excavation was that of a cinnabar mine, where rouge was made.

On page 2608 you see an artist's idea of one of the Seven Wonders of the World, the Greek temple of Diana at Ephesus in Asia Minor. The foundations of the glorious temple have been found, and even the base of the pedestal on which the statue of the goddess stood. Buried in the debris were found hundreds of jewels, statuettes of ivory, bronze and terra cotta, hairpins, beads, earrings, brooches and some of the earliest coins known to history, over 3,000 objects in all.

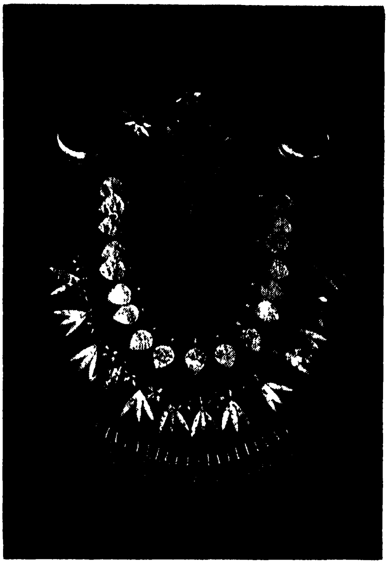
For more than half a century there have been attempts to excavate the ancient city of Ur, called in the Bible Ur of the Chaldees, where Abraham lived. Abraham was alive about 2100 B.C.; but even at that early date the glory of Ur had already faded into legend. The city had been in its prime more than two thousand years before. At Ur has been found a step-tower, sister-tower to the one at Babylon, the tower of Babel. The work of the archaeologist has been aided here by aviation. The plan of the foundation walls around the tower was puzzling until photographs from the air showed the orderly arrangement of palace, temple and other buildings about the sacred mound. Tombs opened at Ur indicate that when a king died there, in 3500 B.C., he was buried in great splendor, and with him were buried human sacrifices, so that he might have company in his journey to the next world. A grave of a baby girl contained her set of silver dishes. In another grave was a favorite harp, with catgut strings.

Scientific methods save many records that would have been lost a half-century ago. Articles are photographed and sketched as soon as found, dipped in chemical preservatives, and cleaned with scientific skill. When objects are so frail that there is danger of crumbling on exposure to air plaster casts are made.

In India a city has been unearthed, dating from about 3300 B.C., which was richly-built, with large buildings of two or more stories, windows, scientific sanitation and other marks of an advanced stage of civilization. Seals inscribed with writing were found, and statuettes showing costumes of cloth; but no key to the writing has so far been discovered.

Another great ancient civilization of the Near East is that of Crete; and one of the archaeologists who did outstanding work on that island in the Mediterranean was Sir Arthur Evans, who, by the vast number of objects unearthed, showed the Cretan (or Aegean or Minoan, after a king, Minos) civilization to be a sort of bridge spanning the cultures of Egypt and Mesopotamia and the early culture of Greece. Evans discovered the enormous palace of King Minos; its floor plan is so complex that this is probably the labyrinth of Greek legend. Thus we find by digging into the earth proof of the Greek legends just as we find many proofs of the Bible narratives by digging in Palestine and Mesopotamia.

The early inhabitants of the Western world constitute a fascinating study. Elsewhere in this book we tell you something of the Incas of Peru, the mound-builders of North America and the Pueblos of the Southwest.



Courtesy, University Museum, Philadelphia
A queen's ornaments dating back to 3000 B.C.

In the heart of the tropical forest of Mexico and central America, Mayan Indians flourished in stone cities beautifully built and decorated with grotesque sculpture. The Mayas had, in the first century A.D., an advanced stage of culture—picture-writing and artistic achievement in pottery-making, jewelry design and textiles. How far back in time their civilization existed is not known. Like the Egyptians they built pyramids, but theirs served as sundials and altars. Like the Egyptians they worshiped the sun-god. The serpent had religious significance, and there is evidence that at one time they mummified their dead kings. Some scholars think that the ancestors of the Mayans may have wandered to America from Egypt, by way of Asia, perhaps. Archaeologists are now uncovering from the encroaching jungle the remains of the Mayan empires—there were two of them with an unexplained gap of centuries between. There is something exciting, even fierce, about the Mayan art. Although descendants of the Mayas still live in Central America and the Yucatan peninsula they have forgotten their heritage.

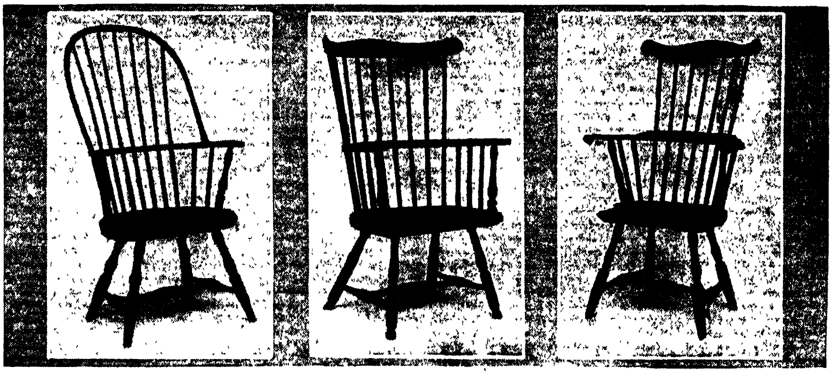
High up in the Andes Mountains, South American tribes lived long before the Inca Empire. They built cities of stone, wove beautiful textiles, made interesting pottery, bronze and silver ornaments, mummified their dead and had knowledge of surgery and medicine. Extensive excavations are now going on in South America. Lakes are being dredged for treasure, since it was with many tribes a pious custom to throw articles of value into a sacred lake or well, to propitiate the god. The Lake of Valencia in Venezuela has yielded up many beautifully carved statues which lay in the ooze for centuries.

There is hardly a section of the world today where the archaeologist is not busy. In India, China and Alaska, in Great Britain and Scandinavia, in France and Italy and Greece, they are at work.

Archaeological study of a somewhat different sort has been carried on for many years by Roy Chapman Andrews, working in connection with the American Museum of Natural History. His expeditions have carried him to Tibet, through The Gobi, to Burma, China and Mongolia in search of information about archaic animal life. He has found many fossil remains, including dinosaur eggs and parts of the skeleton of the largest known land-dwelling mammal, the Baluchitherium. He has proved that central Asia was one of the starting points of the world's reptilian and mammalian life, before the coming of man upon the earth; and he has added much to our knowledge of man as he was before the dawn of civilization.

It is, however, the ancient civilized peoples, dwelling together in communities, that we have been surveying here. The gap between the primitive men and the cultured races has yet to be bridged.

THE NEXT STORY OF ALL COUNTRIES IS ON PAGE 6777.



Three styles of the useful Windsor chair.

FURNITURE IN AMERICA

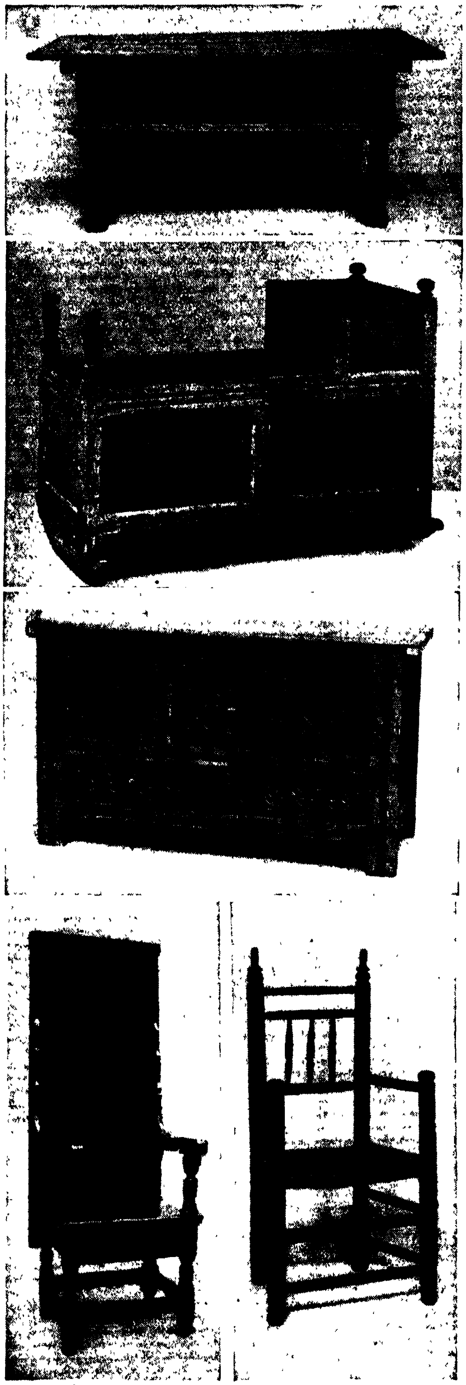
THE story of furniture in America began with the first colonists who made their homes permanently on these shores. The earliest English settlers in Virginia, those who came from Holland to what is now New York and finally the sturdy pioneers who, in the Mayflower and other ships, landed on New England's coast, all lived in much the same way during those first trying years.

Having built small houses, they placed in them, for the most part, the simplest furniture that could be made at the time to take care of their needs. Blocks served as stools, ax-hewn planks laid on trestles did duty as tables and bedsteads were made of poles, the sides of which were lashed together with ropes. Chests that had been their trunks on the voyage over were among the few furnishings which reminded them of the homes they had left, as little else could be carried in the small ships.

But these crude beginnings were soon passed. Frame, stone or brick houses replaced the first shelters, and the pioneers sent to their native lands for furniture and furnishings to make their new surroundings more like the homes they had formerly known.

The interiors of these early houses were much alike. In the main room where the family lived, prepared and ate their food and carried on many domestic activities, was a great fireplace which occupied a large portion of one wall. It played an important part in the life of the family for the cheerful log fire was used for cooking the meals as well as for heating the room and, at night perhaps, was the only source of light. On each side of the fireplace were the cooking utensils and also a warming-pan so necessary for taking the chill from the beds in the winter months. The low-beamed ceiling and the walls of the room, which were either plastered or sided with wood, were often whitewashed. Windows, few in number, were placed high in the walls as a precaution against draughts.

The furniture, made of oak or walnut, was usually carved in the Tudor or Jacobean style and looked not unlike the church furniture of that and the preceding century which was more than likely its inspiration. A straight high-backed bench or settle, as such a bench was called, and the straight-backed chairs, known as wainscot chairs, had little appearance of comfort. Tables were usually made with drop leaves which helped to save space in a room that had so many uses. One or two drawers were added to the bot-



Courtesy of the Metropolitan Museum of Art.
Sturdy American furniture of the seventeenth century. It was built to last for many years.

tom of the chest as a convenience in storing clothes or linen and these increased in number as new chests were built finally developing into what we call to-day the chest of drawers. In the bedroom was the high four-post bed hung with heavy draperies and beside it, perhaps, a low trundle bed in which the children slept. This little bed could be pushed beneath the larger one when not in use.

In spite of the severe furniture and the plainness of the surroundings, the room was not without charm. Bright-colored materials hung as curtains or valances at the windows, squares of gay turkey-work on the tables and chairs, a few pieces of china and pewter in the open cupboard and the gleam of copper and brass utensils on the hearth, no doubt, gave the room a warmth that helped to cheer our forefathers in their homes set in a dark wilderness which was ever pressing in on them

PLANTATION HOUSES WERE RICHLY FURNISHED

Soon after the Virginia Colony was established, we remember, tobacco became an important product that grew rapidly into a prosperous industry. Ships, carrying tobacco to Europe, brought back the articles that were needed here, especially household furnishings of various kinds. As time went on, the wealth of the southern planters increased and their mode of living was patterned after that of the nobility of England. The plantations, as the large farms were called, extended over thousands of acres and the spacious plantation houses were richly furnished. A fine example of a plantation house is the home of George Washington at Mount Vernon. Some of the furnishings now in this house belonged to George Washington and are representative of the period in which he lived—the eighteenth century.

THE RESTORATION OF HISTORIC WILLIAMSBURG

However, not all southern colonists lived on plantations. Towns grew in size, the most noted of which was Williamsburg, so-named for William III of England. From 1699 to 1779 Williamsburg was the capital of Virginia where the governors and burgesses, or members of the assembly, lived in a manner befitting gentlemen who governed a rich and prosperous colony.

To-day, if we should go to Williamsburg, we would find that it looks very much as it did nearly two-hundred years ago. The governor's palace, the stately Capitol, tavern and other buildings have been rebuilt or restored and are furnished as much as possible with pieces of furniture made during the eighteenth century.

AMERICAN FURNITURE FOLLOWED THAT OF ENGLAND

Between the time of the first settlement in 1607 and the Revolutionary War when the colonies became independent, many changes took place in styles of furniture in England which the southern colonist, buying largely from England, followed. The early period of heavy carved oak, known as Tudor or Jacobean, gave way to the lighter walnut pieces of the William and Mary and Queen Anne Periods. These in turn were superseded by the mahogany of the master craftsmen—Chippendale, Adam, Hepplewhite and Sheraton. The Mahogany Period, as it is called, is looked upon as the peak of all times in furniture-making, for Chippendale and those who followed him loved to create designs in the wood that repaid their work in its lustrous gleam.

In our story The Art of Furniture are shown examples of the style of the master craftsmen. Wealthy American homes of this time contained furniture of the same type upholstered in silken brocades and set off with draperies of rich fabrics, imported bric-a-brac and crystal chandeliers that added to the charm and elegance of the room. Those who could not afford to import their furniture contented themselves with copies of these pieces turned out by local joiners. Decorating their rooms with chintz rather than the richer fabrics, they created homes of good taste that some think even surpassed the more pretentious dwellings.

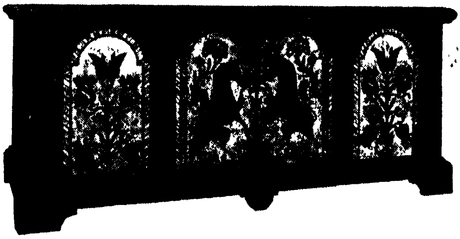
DUTCH FURNITURE OF NEW AMSTERDAM

The Dutch people, who began to settle in New Amsterdam soon after Henry Hudson had claimed this territory for the Dutch in 1609, favored stone as a building material for their houses and brought from the Netherlands much that was to make them comfortable in this new land.

The centre of interest in the Dutch home was always the fireplace with a carved mantelpiece decorated with tiles often the lovely color we know as Delft blue. Bits of this same color showed in the chinaware which, along with pewter dishes, was arranged in the open cupboard. Heavy straight-backed chairs, gate-leg tables, stools and cupboards made of dark oak were of the Flemish type, which, though similar to Jacobean, differed somewhat in shape and line. Beds were sometimes built into the wall like bunks.

Courtesy, Brooklyn Museum of Art.

Although New Amsterdam became an English colony, Dutch people living there continued to build and furnish their homes in the Dutch manner. The "kas," or cupboard, shown here, was greatly favored, as well as the Delft ware pieces placed on it.



Courtesy, Pennsylvania Museum of Art.

A chest, often called a "dower" or "marriage" chest, was used by the German people who settled in Pennsylvania. Their love for bright colors found expression in their furniture, which was painted in a variety of hues. Fireplaces and cupboards, too, were gaily painted.

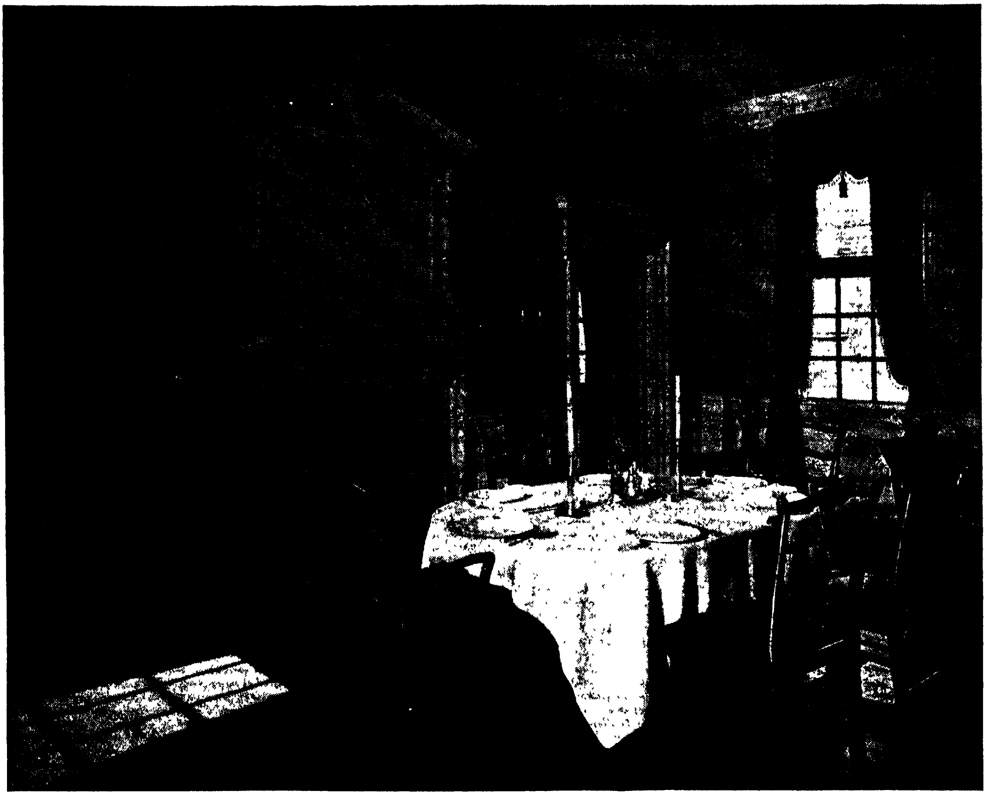
In 1664, the Dutch lost their colony to the English who soon outnumbered the original colonists although Dutch influence long survived in the architecture and furnishings of the houses in New York and in the Hudson Valley.

NEW ENGLAND COLONISTS MAKE THEIR FURNITURE

In the New England Colony, the pioneers were not brought to sudden wealth as the southern colonists had been and they soon learned to depend on their own resources for their needs. It was not long before many men who had had no training in cabinet-making became deft enough to construct rush-seated chairs, tables and chests of hand-hewn lumber, using, for the most part, pine and maple of which there was great plenty.

Pieces of the best furniture made in England, which were brought over for the houses of governors, merchants and other men of note were copied by colonial cabinet-makers and carpenters. As these men had not the tools or the skill to give their products the exquisite finish that distinguished the articles brought from Europe, their tables, chairs and cupboards were likely to be a little heavier in make and more clumsy in outline than those from which they took their designs. Their greatest success was reached in large pieces which were difficult to import. Handsome highboys in which the wardrobes of the whole family could be stored away were peculiar to this continent. Many examples of the colonial craftsmen's handiwork are cherished now in private homes and in museums.

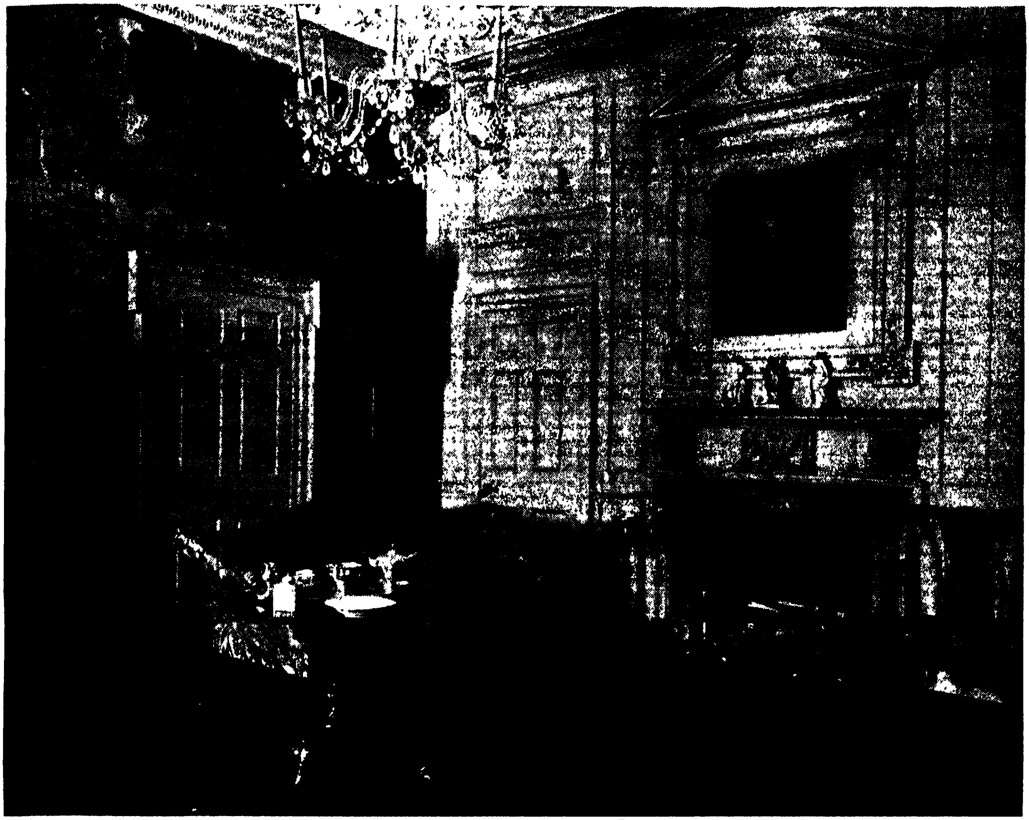
There was one quite simple style of chair introduced from England which, when changed a little, came to be (like the rocking chair) a distinctively American piece of furniture. It had slender upright spindles in the back, which was rounded in a comfortable curve; the seat was nicely shaped of solid wood, and the legs slanted outward, but were made secure by three underbraces connecting them. These chairs, light in weight and in appearance, but strong for use, were called Windsors. They were made in a variety of styles, fitting many needs. When properly proportioned and finely finished, they had true beauty. In a Windsor chair, it is said, Jefferson wrote or signed the Declaration of Independence. Washington used a Windsor writing chair, and on his veranda at Mount Vernon there were thirty other Windsors. Years afterward Windsor writing-chairs were dignified by serving the authors, Emerson and Hawthorne in their homes in New England.



Courtesy Colonial Williamsburg, Inc.

The Daphne Room of Raleigh Tavern, which has been rebuilt, looks much the same as it did in the days when the tavern was the centre of social life in Williamsburg, Virginia. Carved mantelpiece and woodwork, Chippendale furniture, mirror and draperies show the excellent taste of the eighteenth century.

Besides having examples of European furniture to copy, the American workers in wood possessed the books of English architects and designers, and had the advantage of studying their experience and ideas. A man might get his only training in the woodwork of the shipyards, and yet develop an art almost as true as that of Robert and James Adam. Such was Samuel McIntire of Salem, Massachusetts, whose artistic feeling found expression in building beautifully proportioned houses, with dignified stairways and graceful ornament in all the woodwork. Architects to-day go to Salem to study McIntire's designs.



Courtesy of the Metropolitan Museum of Art.

An eighteenth century room that was formerly in the Powel House in Philadelphia. This furniture, made by Philadelphia craftsmen, follows the style of Chippendale. The strap-backed chair with "cabriole" (curved) legs carved at the "knees," the "ball and claw" foot used on tables and chairs is typical of one Chippendale style.

Other craftsmen carried on the art of furniture-making and, while basing their designs on those of English masters, developed a style which had a grace of line and beauty of carving that was distinctly individual. Among the foremost on the list of master workmen from whose hands came furniture that we cherish among our treasures are William Savery, Benjamin Randolph and Jonathan Gostelowe of Philadelphia, which city in the middle and latter part of the eighteenth century was an important source of fine furniture in America. John Goddard of Newport, Rhode Island, was also a cabinet-maker of the first rank, whose high boys and desks are especially prized.

But most outstanding of all these American craftsmen was Duncan Phyfe, who began his career at the very end of the eighteenth century. As a young man, he came from Albany to New York City about 1790. At that time fortunes were growing and new houses were being built, with a consequent need of new furniture. Through the influence of a daughter of John Jacob Astor, who was an early patron, Phyfe's furniture soon became known for its excellence; and orders from Philadelphia, Albany and other places were added to the

Duncan Phyfe made the lovely furniture that is shown in this room, in the Museum of the City of New York. In this early period of his work, Phyfe followed the style of Adam and Sheraton, and his tables, sofas and chairs were delicate in design. The American eagle above the mirrors was much used in decoration after it was adopted as the emblem of the new United States. Furniture and mirrors like these are rare.

New York demands, until a hundred journeymen cabinet-makers were at work under the master.

An artist with his tools, this little man, short pipe in mouth, fashioned models in his workshop, while far off in the southern forest, logs of mahogany, chosen because of superior quality, were marked with his initials by West Indian exporters. These men spoke of Duncan Phyfe logs as New York society ladies spoke of Duncan Phyfe furniture. Sometimes a log cost him as much as $1,000, a large sum in those days, and we cannot wonder that the precious material was stored in a private yard. No one could handle the fine wood so as to give it a more beautiful finish than Phyfe himself.

As to designs, he learned much from the study of Adam and Sheraton, but he had his own original style, a sense of exquisite proportion and delicate finish of detail. Unfortunately his best work was followed by some less beautiful in design, though not inferior in workmanship. For fashion was too strong to be defied by this sturdy Scotsman, and he had finally to yield to a demand for copies of Empire models then being created under the Napoleonic Empire in France.

AMERICANS TURN TO FRANCE FOR NEW IDEAS

Napoleon, we may remember, fostered new ideas in many forms of art, which Americans soon adopted, including the Empire style furniture. Among the first to set the fashion in this country was President Monroe who in 1821 imported French furniture for the newly rebuilt White House that had been burned by the British in the War of 1812.

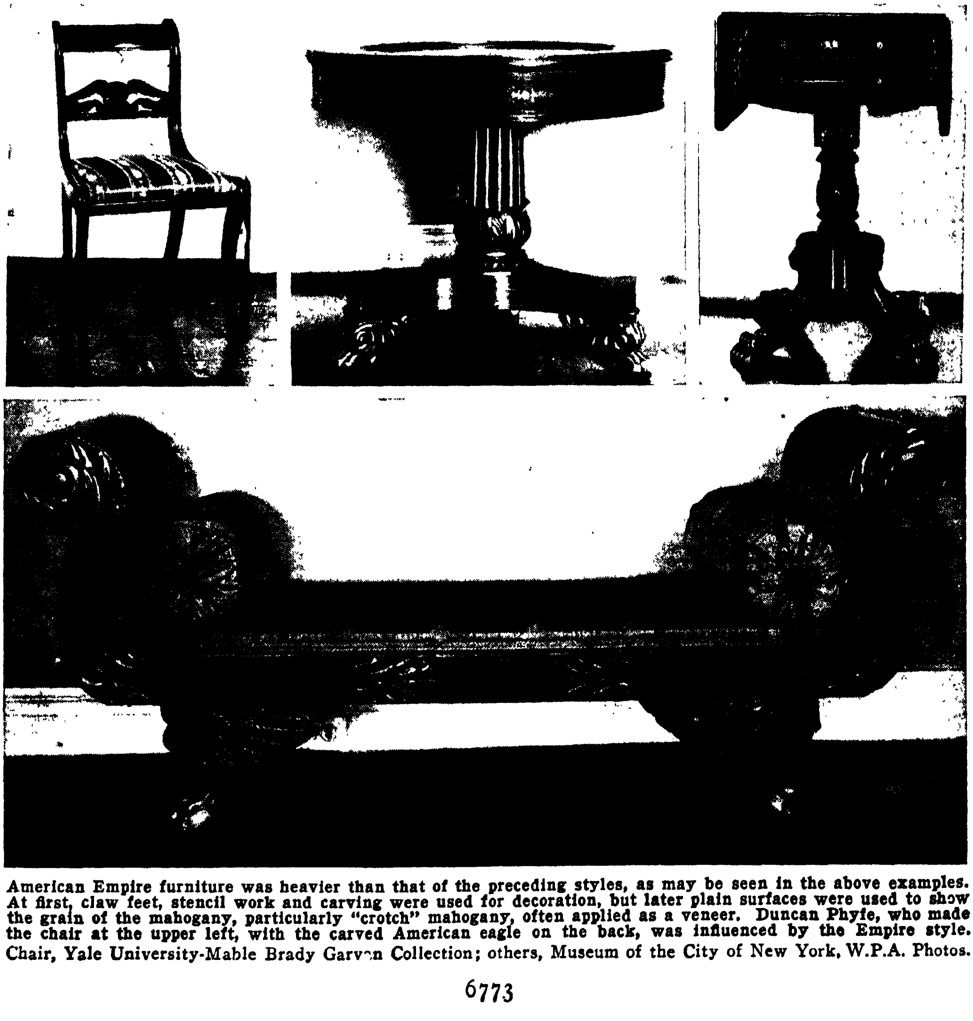
American cabinet-makers modified the designs of the French originals retaining, however, the use of an artificial red stain on the wood which was an outstanding characteristic of this period. Although considerable carving was used, the furniture lacked the ornateness and the use of metal work that delighted the French. American Empire furniture developed a heaviness that might be called sumptuous and reached its height in such well-known pieces as the sleigh bed and lyre-based table with which we are all familiar.

VICTORIAN FURNITURE BECOMES THE RAGE

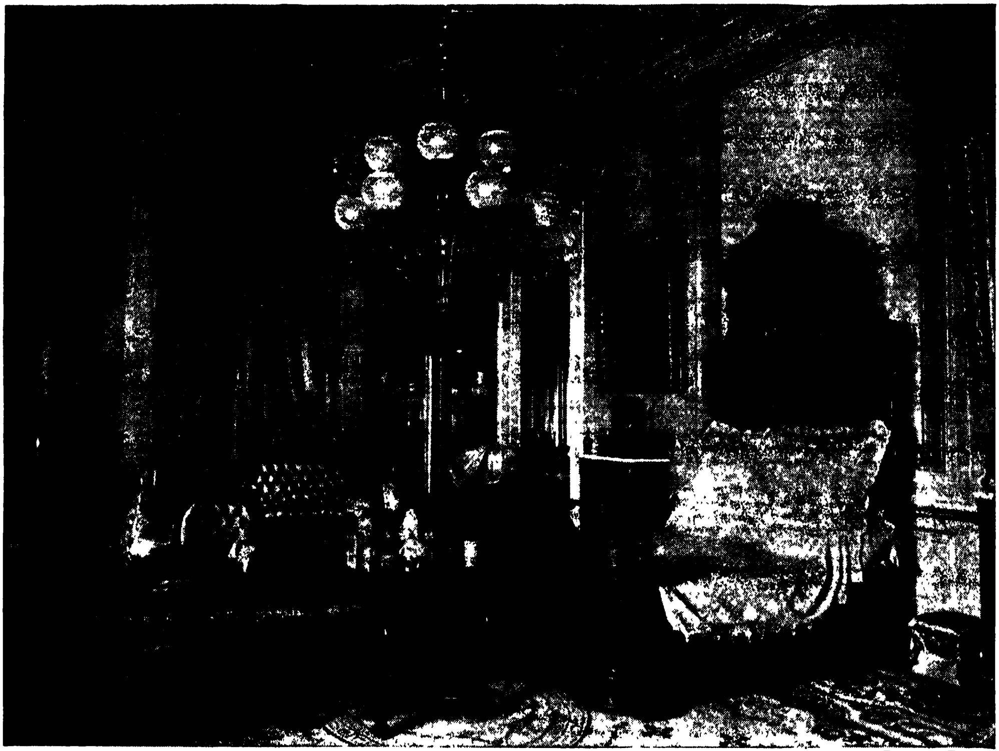
About the middle of the nineteenth century, the Empire style merged into what we know as Victorian. The furniture of this period obtained its name from the English Queen, Victoria, whose long reign dominated and gave her name to everything cultural for over half of the nineteenth century.

Early Victorian furniture had something of the simplicity of the preceding style, but walnut wood completely replaced mahogany. However, ornamentation soon gained favor and numerous scrolls and intricate curves covered every part of the furniture. Marble tops were used on bureaus, which had heavy frames for the mirrors and many little shelves to hold bric-a-brac of all kinds. Tables also were marble-topped with grotesquely curving legs or fancy pedestals. The upholstery on the chairs and sofas was usually tufted, and a favorite material was black horsehair cloth. A whatnot was found in every parlor, while no mantel seemed quite dressed without its ruffle or lambrequin.

In the history of all things that have been made by hand, there has come a time when machines have been invented that did



American Empire furniture was heavier than that of the preceding styles, as may be seen in the above examples. At first, claw feet, stencil work and carving were used for decoration, but later plain surfaces were used to show the grain of the mahogany, particularly "crotch" mahogany, often applied as a veneer. Duncan Phyfe, who made the chair at the upper left, with the carved American eagle on the back, was influenced by the Empire style. Chair, Yale University-Mable Brady Garvan Collection; others, Museum of the City of New York, W.P.A. Photos.



Courtesy, Brown Bros.

A room furnished about 1878 with Victorian furniture which was the fashion of that time. High carved bedsteads, high bureaus with shelves for holding vases, bottles and other small articles were typical. High-ceilinged rooms accommodated the furniture and elaborately draped curtains adorned the high windows.

the work much more quickly and so it was with furniture. About 1815 the first power machines were invented and before a great many years had passed the cabinet shop, equipped with new labor-saving devices, grew into the furniture factory.

Up to 1850, American furniture had been made almost exclusively in the northeastern part of the United States, but the factories chose to locate where forests could supply the wood without the difficulties of transportation. Grand Rapids in Michigan and High Point in North Carolina became the centres of the furniture manufacturing, and to-day these same cities lead in the production of wooden furniture.

When the machines did the work, it was not possible to give each piece the same artistic, loving care that the enthusiastic craftsman had lavished upon it. They, with only a few men in their employ, had been able to oversee every bit of the work done. In the factory, hundreds and thousands of pieces exactly alike were bound to appear, which, lacking a master's thought and touch, were likely to be commonplace if not ugly.

During the early years of machine-made furniture, there was an attempt to reproduce the styles of hand-made furniture, but the desire to create something new prevailed and so in the Victorian Period innumerable variations of the style were made by those who had no artistry and little thought save that their goods must sell.

In the early years of the twentieth century, or perhaps a few years before, oak furniture replaced walnut although this was in no way a return to the style of oak furniture made in the seventeenth century. Golden oak, so-named from the golden finish that was given to it, was lacking in artistic merit and the dark Mission style that followed was heavy, angular and clumsy. It took its name from the furniture used in old Spanish missions of Mexico and the Southwest, which it pretended to copy. Both golden oak and Mission styles were short-lived as far as fashion was concerned.

After the World War, American manufacturers, copying designs that had originated in Europe, introduced a new type of furniture which is called Modern. At first, it was not at all popular as it broke away so entirely from what had been known before, but after a few years, many recognized the beauty of straight simple lines with no carving or other decoration. Modern furniture goes apace with Modern architecture, emphasizing straight lines both vertical and horizontal. Low, deep-seated chairs and sofas are made for lounging rather than for sitting upright, but the chief distinction of the Modern style lies in the frequent use of light-toned woods, brightly-polished metals and mirrors.

REVIVAL OF INTEREST IN ANTIQUE FURNITURE

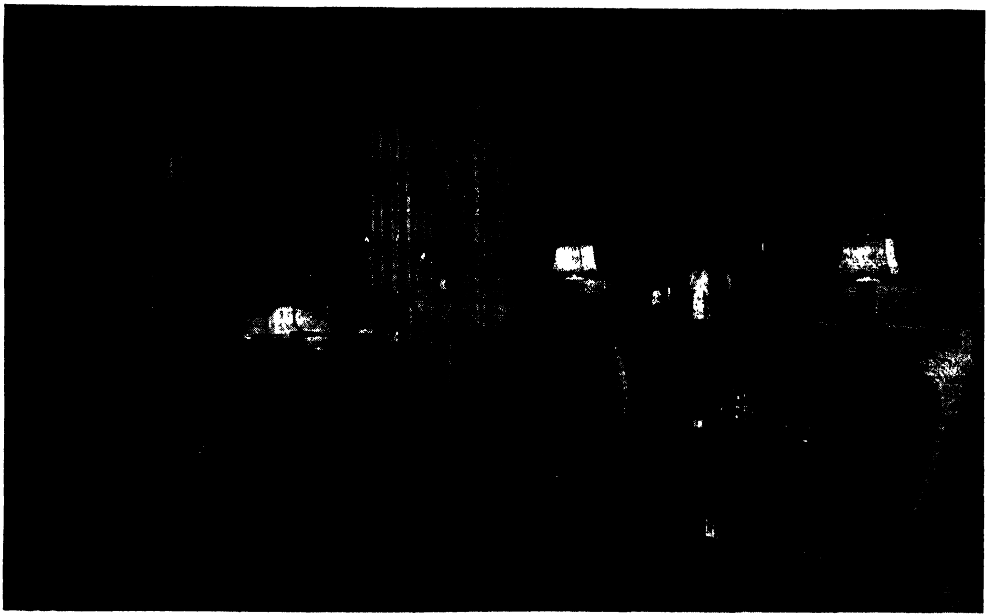
But there has also been a revival of interest in "antiques," for that is what furniture and furnishings of the earlier periods are now called. Collecting antiques has become a hobby for some and a matter of business for others, but whatever its purpose, it has many ardent devotees.

To find the early pieces that had perhaps survived the wear and tear of intervening generations, collectors began a search that took them from cellar to attic and even to the stable, often finding a piece made of fine wood covered with several layers of paint. Much antique furniture has been brought to light—the simple pine and maple, the elegant mahogany, the Empire style and the Victorian. Not the least interesting antique furniture is the gaily painted peasant style made by German people who settled in Pennsylvania late in the seventeenth century. However, not all that is called "antique" is deserving of the attention given to it, for although made by hand and strongly built, it may have been poorly designed. Our ancestors were not all artists.

Meanwhile, the manufacturer set about making reproductions, some of which follow the originals closely, while the cabinet-maker is finding a demand again for his services both in repairing antique furniture and in making reproductions by hand.

In recent years, there has been an earnest effort to create better taste in furniture and home furnishings and their arrangement in the room. Perhaps nothing else will give us more help in forming our own taste than a knowledge of the furniture made by the artists of the eighteenth century.

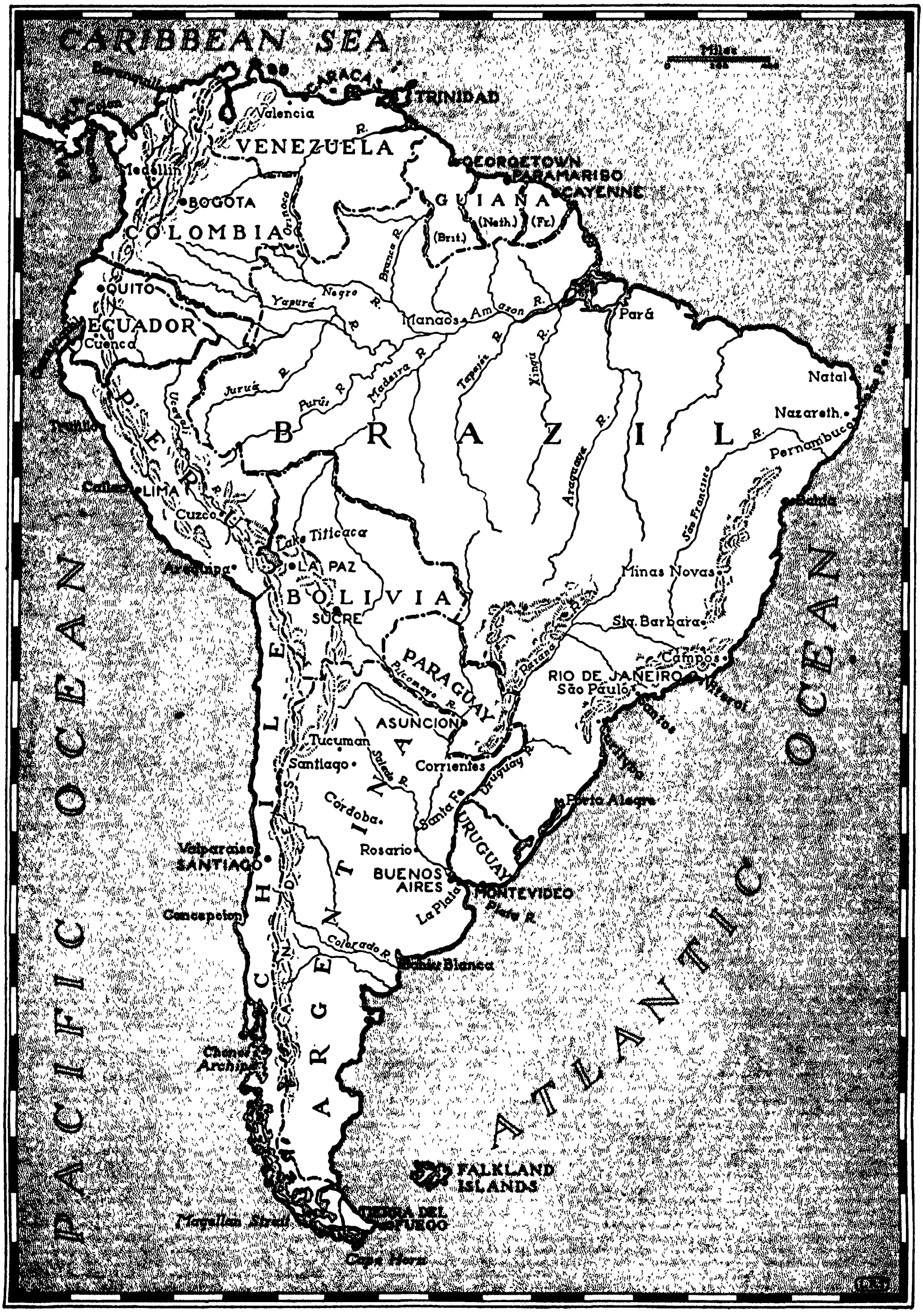
THE NEXT STORY OF THE FINE ARTS IS ON PAGE 6897.



Courtesy, W. and J. Sloane.

The simplicity of a modern room, such as this, is, indeed, a contrast to the Victorian room shown on the opposite page with its great amount of decoration. Plain walls, plain rugs and the lack of pictures or ornament might make the modern room seem coldly severe were it not for the studied color harmony used in modern decoration.

CONTINENT OF SOUTH AMERICA



The three great rivers of South America, the Orinoco, Amazon and Plata, flow into the Atlantic Ocean.

C.I.A.A. photo

River boats at Una, State of Bahia, Brazil, loading cacao for shipment.

THE SOUTH AMERICAN CONTINENT

SOUTH America is the fourth largest continent, with an area estimated at 7,300,000 square miles. (Asia, Africa and North America are larger.) The continent is connected with North America by the narrow Isthmus of Panama, now crossed by the great Panama Canal (see page 361). South America is bounded on the north by the Caribbean Sea and the Atlantic Ocean, on the east by the Atlantic, on the south by the Antarctic Ocean and on the west by the Pacific.

For much of its extent, the coastline is relatively unbroken. There are only a few prominent peninsulas, bays, gulfs and outlying island groups except at the extreme north and south, as we shall see.

Let us suppose, now, that we are taking a trip by boat completely around the continent, starting at the Atlantic side of the Isthmus of Panama. (In this imaginary trip of ours, you will find it useful to refer often to the map on the opposite page.) As we make our way eastward along the South American coast from the Isthmus of Panama, we encounter, off Venezuela, a considerable number of small islands belonging to the West Indies group—Curaçao, Margarita, Trinidad, Tobago and various others.

We skirt the Guianas and make our way along the northern coast of Brazil. We now come upon the mighty estuary of the Amazon—an arm of the sea into which the Amazon and other rivers pour their waters. Thrust into this estuary and almost closing it are a number of islands. They range in size from Marajó, with its 16,000 square miles, to tiny dots of land that barely make their way up above the surface of the sea.

Sailing from the estuary of the Amazon, we round the eastern bulge of South America. From this point on, the Brazilian coast is comparatively regular though it is broken here and there by occasional bays and harbors. When we leave Brazil and sail along the coast of Uruguay, Brazil's sister republic to the south, we come upon a deep dent in the coastline—the estuary of the Plata River. From here we sail along the Argentine coast, which winds in and out with a succession of fairly prominent bays and gulfs.

Here we are now at the extreme south of the South American mainland. As we look across the narrow Strait of Magellan, we see a succession of bleak, rocky islands, separated from one another by irregular

Courtesy, Pan American Airways System

The mountains make railroad-building difficult in many places; travel by air is increasing.

channels. This group is known as the archipelago (island group) of Tierra del Fuego. It has a total area of some 28,000 square miles. Tierra del Fuego is divided between Argentina and Chile. On a small island of the archipelago is famous Cape Horn, the southernmost tip of the continent. Some 400 miles to the northeast lie the Falkland Islands, a British possession, with an area of 4,600 square miles. The Falklands are claimed by Argentina, which calls the islands the Maluinas.

As we continue now up the west coast of South America, Tierra del Fuego gives way to another archipelago that extends along the Chilean coast for a distance of about 800 miles. Here the coast of the mainland forms a wildly irregular pattern, with a succession of deep fiords and inlets and sounds and bays. One might think oneself transported suddenly to the savage eastern coast of Norway.

Beyond Chiloé Island standing guard at the northern end of the Chilean archipelago, there is a remarkable change. The coastline flattens out and thereafter presents only insignificant wrinkles until we reach the Gulf of Guayaquil, in Ecuador, almost 3,000 miles from Chiloé. From the Gulf of Guayaquil to the Isthmus of Panama there are only comparatively small bays and, south of the isthmus itself, the Gulf of Panama.

North of Chiloé Island there are practically no islands near the mainland (unless we include a number of tiny isles that lie off Peru and are too small to figure in most maps). Out in the Pacific at some distance from the western coast of South America, however, there are two island groups which are generally considered to belong to the continent. The larger of the two, the Galápagos Islands, lies on the Equator about 600 miles from the coast of Ecuador, to which this island group belongs. There are about fifty-five islands in the Galápagos; they cover an area of almost 3,000 square miles. Farther to the south, 300 miles west of the Chilean coast, we find the small Juan Fernández Islands, which belong to Chile.

One outstanding feature of the South American mainland is the great Andes mountain chain, which forms a ridge from north to south, hugging the west coast pretty closely all the way. The Andes make up a formidable mountain barrier. They contain the highest peaks in all the world except for those of the Himalaya Mountains, in Asia. Just think! In all of North America, there is only one peak over 20,000 feet high—Mt. McKinley, in Alaska, which rises to a height of 20,300 feet. There are some forty peaks of the Andes that tower above Mt. McKinley!

The Andes begin in the countries of Colombia and Venezuela, with a triple range that suggests the three prongs of a fork. When they reach Ecuador, the three prongs combine to make up the handle of the fork. In Ecuador we find a cluster of volcanic peaks, some active, others extinct. The most famous of these, perhaps, are Chimborazo (20,577 feet) and Cotopaxi (19,613 feet).

As they make their way south through Peru and Bolivia, the Andes widen enormously, reaching a breadth of 300 miles here and there. There are two (in some places, three) mountain ranges, with a lofty plateau between. Here we find a considerable number of giant peaks over 20,000 feet in height—among others, Huascarán (22,180 feet), Coropuna (21,696 feet) and Sunipani (21,326 feet), in Peru; Ancohuma (21,489 feet), Sajama (21,391 feet) and Illimani (21,283 feet), in Bolivia. The passes between these mighty peaks are 15,000 feet and more above sea level—higher, in many places, than the loftiest peaks of the Alps.

South of Bolivia the Andes form a natural barrier between Chile and Argentina. Here they reach their highest point; the Argentinian peak of Aconcagua, which is the loftiest point in all the Western Hemisphere, rising to the great height of 22,834 feet. Some distance farther south, the Andes narrow. For the last few hundred miles the mighty chain forms a comparatively modest barrier — a picturesque barrier, dotted here and there with sluggish glaciers. The mighty Andes come to an end in the rocky isles of Tierra del Fuego.

The western coastal belt, between the Andes and the Pacific Ocean, averages about forty miles in width. From the extreme north to the Gulf of Guayaquil, in Ecuador, this coastal plain is fertile tropical country. Below Guayaquil—in southern Ecuador, Peru and the northern half of Chile—one finds an arid, sandy waste. This is crossed at places by streams flowing from the Andes along narrow, fertile valleys. At intervals, too, a range of foothills runs along the very edge of the coast.

Farther south, in the southern part of Chile, these foothills reach considerable size; they are known as the Coastal Cordillera. Here the coastal plain is a fertile, well-watered area, very much like the coastal regions of the American state of Washington.

The Andes Mountains descend toward the east, in a comparatively gentle slope, to a vast central plain, watered by innumerable rivers. This great lowland area covers by far the greater part of the continent. To the south it extends from the Andes to the Atlantic; it is broken only by occasional foothills and low mountain ranges. Farther to the north the central plain finds its way to the Atlantic Ocean barred by several extensive highland areas rising not far from the Atlantic coast.

In eastern Brazil we find the Brazilian Highlands, a broad plateau running more or less parallel to the coast and ridged with mountain ranges. Farther north, also parallel to the coast, there is another large system of plateaus and mountain ranges—the Guiana Highlands. This area covers the inland part of the three Guianas (divided among England, France and Holland) and the eastern part of Venezuela. Between the Guiana Highlands and the sea, there are some low-lying lands along the coast.

C.I.A.A. Photo

The moist, hot jungle of Venezuela. The plants grow close together in a tangle, hiding the light of the sun.

The great central plain of South America is made up of a number of distinct regions. To the north the tropical forests near the coast give way, in Venezuela and Colombia, to a series of grassy plains, known as llanos (the Spanish word for plains). Here the monotonous expanse of grass is broken only occasionally by scattered clumps of trees.

South of the llanos lies the Amazon Basin, watered by the Amazon River and the streams that flow into it. Here there are immense tropical jungles. In many places the jungle is a dense, forbidding barrier of trees, vines and shrubs, closely matted together. The steaming air, clouds of fierce insects, lurking snakes—all combine to make these areas a "green hell," to quote a Brazilian writer of the last century.

Farther south the land rises to form the great plains of the Brazilian province of Matto Grosso. Proceeding to the southwest, we find the Gran Chaco, which occupies parts of three countries—Bolivia, Paraguay and Argentina. The Gran Chaco is a land of prairies alternating with heavily wooded areas. Next, we come to the immense grassy plains known as the pampas, that extend through Uruguay and much of Argentina. The pampas give way in the southern part of Argentina to the tableland of Patagonia.

South America has the most elaborate network of rivers in all the world. There are three particularly important river systems in the continent—those of the Orinoco, the Amazon and the Plata rivers.

The Orinoco rises in Venezuela not far from the Brazilian frontier, flows northwest, then north, forming part of the border between Colombia and Venezuela, and then crosses Venezuela and empties into the Atlantic. In its long journey it receives the waters of many smaller streams that flow eastward from the Andes. The Orinoco is about 1,600 miles long. Together with its tributaries, it drains an area estimated at over 350,000 square miles.

The mighty Amazon River crosses South America from west to east. Its headwaters are in the Andes Mountains, only sixty miles from the Pacific coast. After flowing over 3,900 miles, the Amazon finally empties its waters in the Atlantic Ocean at the Equator. As the Amazon proceeds along this course, it receives the waters of a great number of tributaries. Some of these, like the Madeira (2,000 miles), the Purús (1,850 miles), the Rio Negro (1,400 miles) and the Tapajós (1,000 miles), are very long and have numerous tributaries of their own. Together with the Amazon, they drain the Amazon basin, a vast area of 2,500,000 square miles—the greatest river basin in the world.

When we speak of the Plata system, we refer chiefly to the streams that empty into the Plata River. The Plata itself is really an arm of the sea, 200 miles in length and ranging in breadth from 25 miles, at its farthest inland point, to 170 miles where it joins the broad Atlantic.

The waters of the Uruguay River (1,000 miles) and, farther west, the Paraná (2,450

Photo, Alice Schalek, from Three Lions

Cattle on the flat pampas of Argentina. Groves of trees in the background have been planted to give shade.

miles) flow into the Plata from the north. The Paraná, in its turn, receives the waters of the Paraguay River (1,500 miles), which has many great tributaries of its own. All of these rivers, making up the Plata system, drain a great area of more than 2,000,000 square miles in northern Argentina, Uruguay, Paraguay, southern Bolivia and southern Brazil.

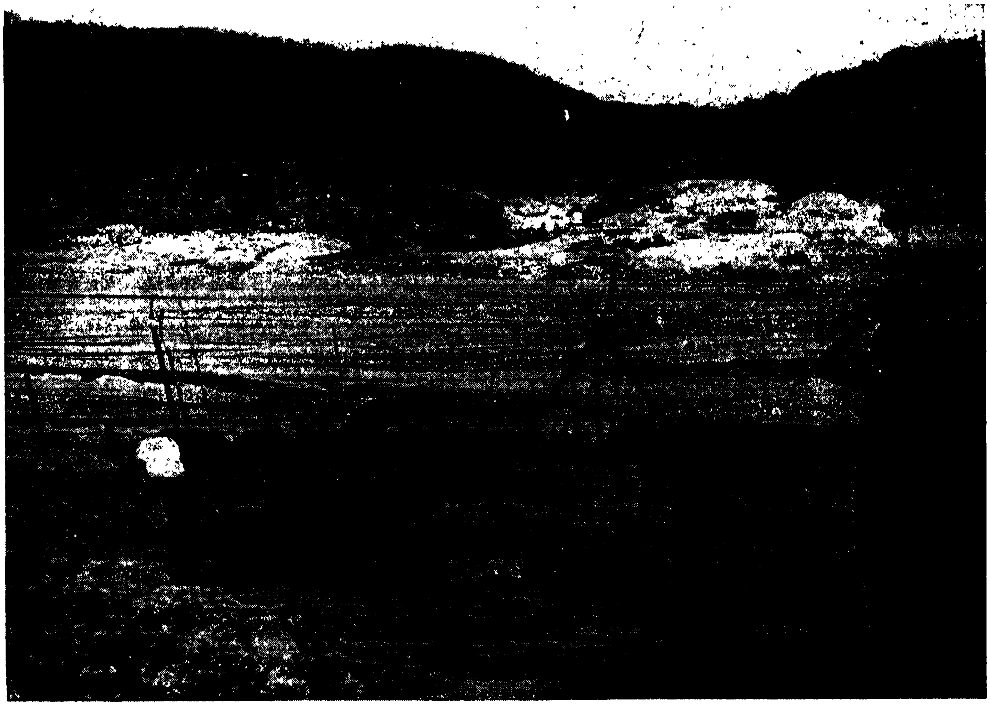
Most of the important rivers of South America are included in the three great river networks that we have just described. Of the others, the Magdalena (about 1,000 miles) flows into the Caribbean Sea, after draining a fertile area between two ranges of the Andes, in the extreme northwest of the continent. A considerable number of rivers drain the Brazilian highlands; the most important are the São Francisco (1,800 miles) and the Tocantins (1,700 miles).

The Potaro River, in western British Guiana, is chiefly notable because its waters plunge over a precipice 741 feet high to form mighty Kaieteur Falls—over four times as high as our own Niagara. The rivers that flow into the Pacific from their headwaters in the Andes are very short.

South America has a number of beautiful lakes set in the lofty plateaus of the Andes. Largest of these mountain lakes is Lake Titicaca (area, 3,800 square miles), through which passes the boundary line between Peru and Bolivia. This lake is the highest in the world; its surface rises 13,861 feet above sea level. Lake Junín, in Peru, is almost as high but not nearly so large.

Lake Maracaibo, which has an area of 6,300 square miles, is in Venezuela, in the extreme northern part of the continent. This is rather a bay than a lake, since it is connected with the Caribbean Sea by means of a strait about fifty miles long and from eight to fifteen miles wide. A number of rivers flow into the lake and hence its waters are generally fresh. However, they often become quite salty when strong winds from the Caribbean prevail.

Along the eastern coast of Brazil one comes upon a number of lagoons—shallow bodies of water near or actually connected with the ocean. The largest of these is the Patos Lagoon, near the southeastern tip of Brazil. Its salty waters extend over an area 150 miles long by 30 miles wide.



Courtesy, Pan American Airways System

Searching for diamonds in a river of Brazil. A number of precious stones are found in South America.

There are a number of other lakes in the areas drained by the great river systems. These lakes are often considerable in extent when the countryside is flooded in the rainy season, but they dwindle away as the floodwaters go down again. Some disappear entirely.

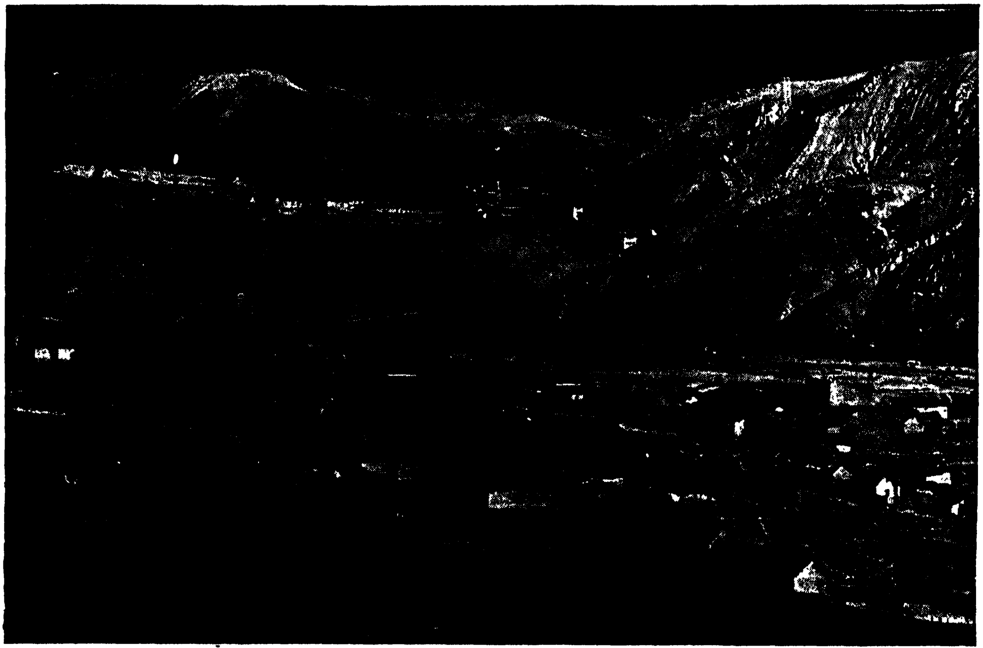
Mountains, plains, rivers, lakes—one is apt to think of these as enduring things. Yet they have acquired their present shape and size only after ages of constant change. There was a time, long, long ago, when South America consisted only of a chain of islands extending from the Caribbean to the extreme south—mountainous islands, towering many thousands of feet in the air.

As time went on, the wind and the rain lashed unceasingly at these islands. The materials washed down from their slopes helped to build up the channels between them until a continuous land-mass was formed. To-day we still find traces of the old island-mountains in the highlands of Brazil and Guiana and in the Falkland Islands.

Later, the eastern land-mass became part of a huge continent that modern scholars call Gondwanaland—a continent that extended as far west as the Andes and was joined to Africa in the east. The region now occupied by the Andes Mountains was a channel between Gondwanaland and another vast continent lying to the west. This channel emptied at the north into an enormous sea—the Tethys—which extended from the West Indies to the Mediterranean Sea.

In the course of time, the Atlantic Ocean divided South America from Africa, and the great continent west of the Andean channel sank into the Pacific. To the north the Isthmus of Panama appeared above the surface and provided a land bridge leading to a northern continent. Heaved upward by the volcanic stirring of the earth, the Andes rose from the waves to form a lofty mountain barrier. Still later, in the Ice Age, mighty glaciers covered the southern part of the continent; they carved out mountain lakes, fiords and bays. As we have seen, glaciers are still to be found in the southern part of the Andes chain.

Three-quarters of South America lies within the tropics, and this fact has a most important bearing on the climate of the continent. It is very hot in that part of the great central plain which is in the tropics—particularly in the lands watered by the Orinoco and Amazon river systems. The heat is sometimes tempered, however, by

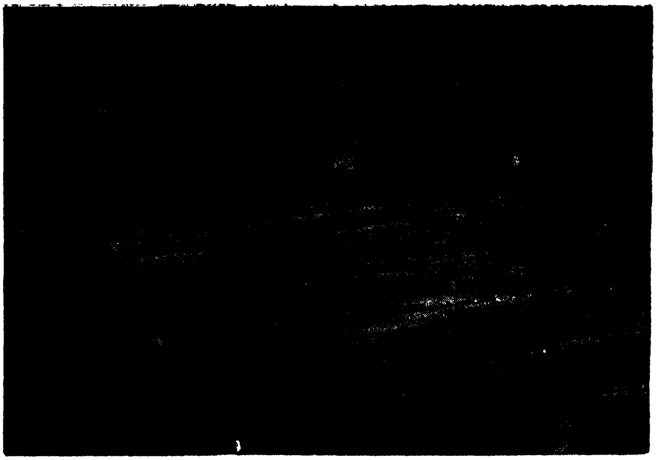


Courtesy, Fortune Magazine; photo, Fenno Jacobs from Three Lions

Bolivia is the world's third largest producer of tin; this is Bolivia's richest tin mine, at Llallagua.

strong winds blowing from the Atlantic. It is colder in the highland areas of the tropical regions. It is cool in the plateaus of Peru and Bolivia and cold on the peaks that line these plateaus.

Farther to the South lies the temperate zone of South America, including southern Brazil, southern Paraguay, Uruguay, Argentina and Chile. Here the climate is usually moderate. The winters are not so severe, the summers not so warm as in North America's temperate zone. The seasons in this part of the world are just the reverse of those in the temperate zone of North America, and of Europe. July, for example, is a winter month in Buenos Aires, January is a summer month.



C.I.A.A. Photo

Floating balsa logs down a river in Ecuador, to the sawmill. Balsa wood is lighter than cork, yet strong.

It is cold in the mountains of the southwest. The climate is particularly wretched in southern Patagonia and in Tierra del Fuego; there are almost continuous gales, with frequent storms of wind-driven sleet and rain.

The winds sweeping inland from the Atlantic Ocean bring moisture to a vast area of South America, from the Caribbean Sea south to the Tropic of Capricorn. The rainfall, therefore, is generally great in the northern and central areas of the continent, east of the Andes. The pampas and the northern part of Patagonia receive much less moisture.

The Atlantic winds lose most of their moisture when they strike the lofty barrier of the Andes. As a result, rain rarely falls in much of the Pacific coastal belt from the Gulf of Guayaquil to the southern part of Chile.

North of Guayaquil a warm ocean current called the Niño (child) bathes the shores of the western coastal plain and brings abundant rains. There is heavy rainfall, too, in southern Chile, where the moisture-laden winds from the Pacific blow. These winds cross the low barrier of the Andes in the extreme south and give plenty of moisture to southern Patagonia.

There is a wide range of vegetation in the South American continent. There are mighty forests in the tropical jungles of the Orinoco Delta, the Amazon Basin, the Guiana Highlands and in other districts. The Amazon Basin has the greatest forests of all. Here we find countless acacias, myrtles, laurel trees, cacaos, fig trees, rosewood trees, the *Hevea brasiliensis*, from which we get rubber, and the babassu palm, which yields valuable oils.

In the moist coastal areas of Colombia and Ecuador, we find the tagua palm, from the nuts of which buttons are made. Coffee trees flourish in Brazil and Colombia; pine forests, in the highlands of southeastern Brazil and in central Chile; wax palms, in the Gran Chaco.

Among the shrubs of South America are the cassava plant, the root of which gives us tapioca; the castinga, a thorn bush of northern Brazil; and a Brazilian holly bush, the leaves and shoots of which are used in preparing maté, a favorite South American drink. In the regions of great rainfall and steady tropical heat, there are flowers in wild abundance—orchids, pansies, begonias, irises, lilies and many other species.

South America's agricultural products help to supply the markets of the world. Brazil and Colombia export vast quantities of coffee. The rich pampas of Argentina and Uruguay are ideal for the cultivation of all sorts of cereals; wheat, corn and barley, in particular, are grown on a very extensive scale. Cotton thrives in Brazil and Peru. Certain agricultural products—such as potatoes, tomatoes, peanuts and lima beans—are native South American plants, which have been introduced successfully in many other parts of the world.

South America possesses enormous mineral wealth. Chile has the world's largest deposits of nitrate of soda. Bolivia supplies most of the world's bismuth and thorium. Chile is the second largest producer of copper; the metal is also mined extensively in Peru and Bolivia. Bolivia is third among tin-producing countries. Colombia is one of the chief sources of platinum. The Guianas have great deposits of bauxite (from which aluminum is made).

There are immensely productive oil-fields around Lake Maracaibo and in other districts of Venezuela; this country ranks third among the foremost producers of petroleum in the world.

C.I.A.A. Photo

Loading copper ore at Chuquicamata, 125 miles from Antofagasta, Chile. Here is one of the world's greatest deposits of copper ore.

C.I.A.A. Photo

Storage tanks at a Chilean nitrate plant. The desert of northern Chile contains enormous deposits of nitrates from which sodium nitrate, for fertilizer, can be secured. Once Chile supplied almost all the world's nitrogen products.

There are vast iron deposits in the Andes, particularly in Chile, and also in the Brazilian Highlands. Hundreds of years of intensive mining have not exhausted the great gold and silver deposits of the Andes. Other mineral products of South America include sulphur, lead, manganese, tungsten, industrial diamonds, graphite, mercury, rock salt, mica, emeralds, amethysts and topazes.

The animal life of South America is rich and varied. One finds here a number of species unknown in other parts of the world. There is the lazy sloth, which spends much of its time hanging upside down by its claws from the branches of trees. The haughty llama thrives on the plateaus of the Andes; and so do the closely related vicuna, alpaca and guanaco. The pichichago, a tiny armadillo, only six inches long, lives underground like a mole. The tapir, the largest of all South American mammals, is found in only one other place besides South America—the Malay Peninsula.

The cat family is represented by the savage jaguars, ocelots and pumas. Otters and ferrets abound. The cries of the guariba monkey, or howler, fill the tropical jungles. The only representative of the bear family is the picturesque Andes or spectacled bear (so called because of the rings of whitish fur around its eyes).

South America has countless species of birds, particularly in the jungle areas—parrots, macaws, toucans, tanagers, pigeons, curassows and others. Wading and swimming birds abound in the rivers of the continent. The rhea, a large ostrich-like bird, runs over the open spaces of Paraguay, northern Argentina and Uruguay. The most interesting bird of all, perhaps, is the hoatzin, which looks like a left-over from a previous age, a cousin, perhaps, of the archæopteryx, an extinct bird with lizard-like teeth.

Fish teem in the numberless rivers of the

Brazilian Government Trade Bureau
An anaconda basking in the sun, at the river's edge.

continent. In the waters of the tropical jungle there are sting rays and electric eels, there are also schools of little saw-toothed piranhas (pee-rahn′-yahs) which have been known to attack the largest animals. The largest tropical food fish is the pirarucu, which is often ten feet long and weighs several hundred pounds. In other areas of South America, the rivers yield great quantities of salmon, eels and trout.

Reptiles are well represented in South America. The largest snake is the boa constrictor, which lurks in the tropical forests. Among the poisonous snakes are the bushmaster, a member of the rattlesnake family, and the little coral snake, which is as pretty as it is deadly. Alligators and turtles swarm in the tropical rivers. In the Galápagos Islands, off Ecuador, one finds giant tortoises that weigh hundreds of pounds. The shells of these creatures are often more than three feet in diameter.

The jungle districts of the Amazon are a paradise for insects. There are countless swarms of mosquitoes, some of which carry the deadly malaria germs. Ants, termites, beetles, hornets, wasps, cockroaches, walking-sticks, moths and butterflies abound in almost unbelievable numbers. In the jungle, too, we find those very unpleasant relatives of the insect tribe—ticks, centipedes, scorpions and spiders of enormous size.

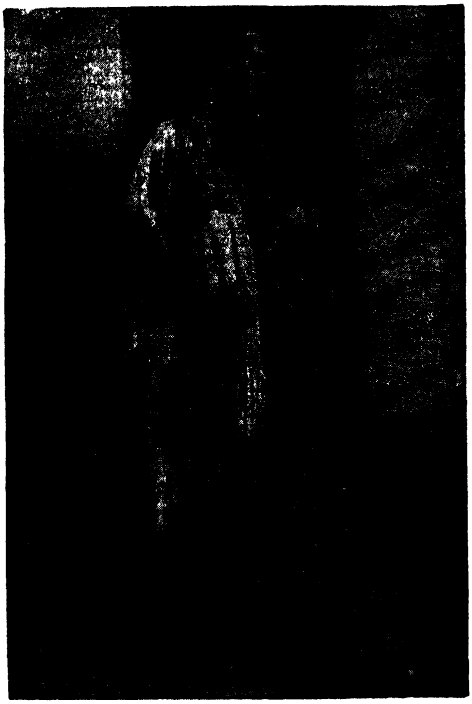
Before the coming of the Europeans, there were no cattle, sheep, pigs or horses in South America. These animals were brought in by the Spanish and Portuguese conquerors and they thrived in their new surroundings. To-day they range in vast numbers in the plains of Uruguay, Paraguay and Argentina, where they rival the flocks and herds of the North American prairies.

South America has an estimated population of 90,000,000—an average of only twelve inhabitants or so to the square mile. Unlike their North American brothers, the native Indians of South America have held their own, in numbers at least. Pure-blooded Indians form a large part of the population of Bolivia, Ecuador, Peru and Paraguay, and they are fairly numerous in other South American countries.

White immigrants from Europe have settled particularly in southern Brazil, Uruguay and Argentina, where the climate is most like that of Europe. The result is that the whites are greatly in the majority in these areas. Elsewhere they are outnumbered by the Indians and by the mestizos (mess-tee′zohs)—that is, people of mixed Indian and white blood.

Considerable numbers of Negroes were brought to Brazil from Africa to work in the

C.I.A.A. Photo
For more than four hundred years, llamas have been domestic animals in Peru, Bolivia and the mountains of Chile. The males are pack animals; the females furnish milk and meat. Llamas are distant relatives of the camel.



Courtesy, Pan American Airways System
A native of Brazil, with Indian and Negro blood.

fields during the colonial period, when Brazil belonged to Portugal. As a result there is a fairly large Negro population in Brazil. Japanese and Chinese have immigrated to some of the countries on the Pacific coast, particularly Peru and Ecuador. Japanese have also settled in certain areas of Brazil.

The South American continent was divided almost entirely between the Spaniards and the Portuguese after the era of discovery. To-day the flags of Spain and Portugal have disappeared from the continent. The British rule over the Falkland Islands in the southeast; they share the Guianas with France and Holland. The rest of the continent is occupied by ten independent countries—Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Paraguay, Peru, Uruguay and Venezuela.

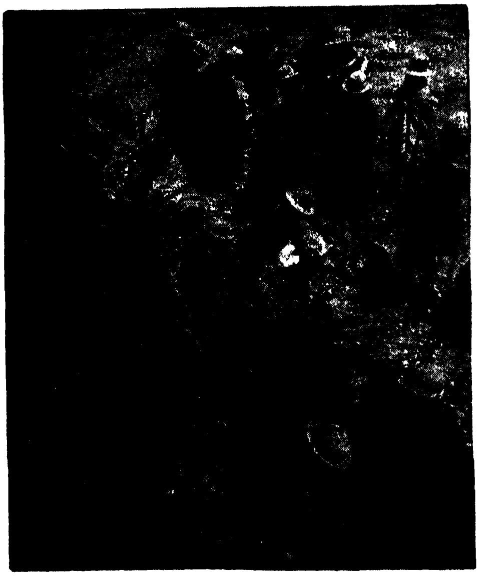
Two European languages are all-important in South America—Portuguese, which is spoken in Brazil, and Spanish, spoken in the other independent countries. English is the official language in the Falklands and in British Guiana; French, in French Guiana; Dutch, in Dutch Guiana (Surinam). A great variety of Indian tongues are still used by the large Indian population. Among the most important of these languages are Quechua (in Bolivia, Ecuador and Peru), Aymara (in Bolivia and Peru) and Guarani (in Paraguay). Some Indians speak only their native tongue; others know Spanish as well.

Perhaps more than any other continent, South America is the land of the future. Up to the present her immense resources have not been fully developed. For one thing, the climate and the difficult living conditions have discouraged settlers in some of the richest areas of the continent—particularly in the great Amazon Basin. In many regions transportation has been difficult. Railroads were few.

Yet South America has made steady progress. Many areas in the tropical regions have been made safe for colonization by advances in sanitation. Fine roads are being built; extensive air routes have been developed. New industries have been started; old ones have been enlarged.

Above all, there is a new spirit of co-operation. The countries of South America have come to realize, like their sister republics to the north, that the prosperity of each nation of the Western Hemisphere is bound up with that of its neighbors. Pan-Americanism (see page 7049) is no longer a dream; it has become a vital force.

THE NEXT STORY OF ALL COUNTRIES IS ON PAGE 6803.



Courtesy, Grace Line
A market in the mountains of Bolivia. Most Bolivians are Indians or of mixed Indian and white blood.

JACKAL OF THE DEEP

By PAUL ANNIXTER

(Reprinted by permission of the author.)

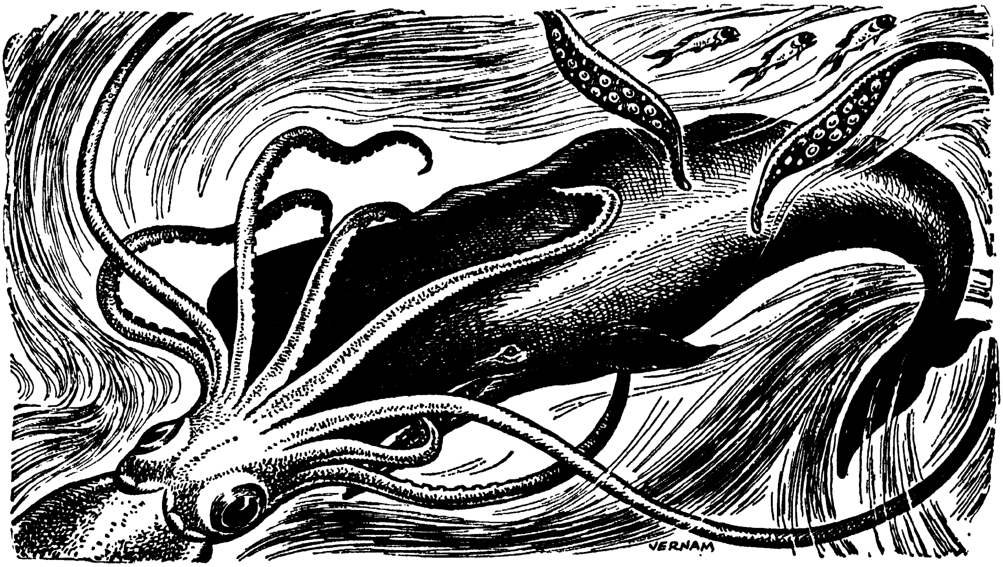
THOUGH dawn was close at hand, the full tropic moon still hung like a burnished coin in the empty immensity of the sky. The big southern stars were paling, and faint mists began to lift above the long purple swells of the sea, tinted like mother of pearl in the milky luminance. The mid-December heat was on, and the warm surface waters shone by night like molten silver with the teeming of untold billions of tiny phosphor animalcules, whose witch-fire makes up much of the glamour and mystery of the southern seas.

Without herald the flaming disc of the sun poked above the heaving horizon, changing from dull red to flame-white all in a minute.

The vast indolent expanse of the sea was deserted. No land was in sight; nothing moved to break the immutable peace and remoteness of sea and empty sky. But presently far to the north a sudden geyser of white water jetted twenty feet in air and fell back, while across the waters sounded a booming crash that echoed like a water hammer. Soon there came in sight a strange shape wallowing along contentedly. It looked at a distance like a submerged balloon, or a small island. It was a cow cachalot, or sperm whale, and by her side swam a two-months'-old calf, hugging close to her vast flank as if apprehensive of unknown perils in this alien sea. From time to time the mother would pause and half turn to nuzzle the youngling gently with her broad rounded snout to assure herself that all was well with him, for the whale tribe are not cold-blooded, but true mammals, and the most assiduous of parents.

Thirty feet long the young cow cachalot was, and yet she was small compared with the average members of her clan. But every inch of her was in fighting trim, hard as steel, and unhandicapped by blubber. Of all the monsters of the sea there were none to whom she would give ground, for the sperm whale when roused is the fiercest and most indomitable of living things.

Three months before, in the chill Atlantic currents off Newfoundland, the she-cachalot had been seized with one of the strange wandering fevers that often attack her clan. Abruptly leaving a vast school of her kind, she had answered the call, which had drawn her south, and ever southward, toward new



This devilfish was a giant of his kind. His tentacles were as big around as flagpoles.

and warmer waters. Six thousand miles and more down the world's bulge she had come, stopping only at intervals for a day or two when happening to contact a member of her itinerant tribe.

About mid-forenoon this day the mysterious urge that had been driving her onward through nearly ninety tireless days came abruptly to an end. It came home to her softly that her driving restlessness had left her, and here she elected to remain. For a time mother and son floated lazily on the warm surface of the smiling noonday sea, apparently basking in thoughtless content. But the fierce little eyes of the mother were constantly probing the beryl-colored depths beneath for any chance meal that might come within range.

Jutting out from an island, some ten fathoms below the surface, ran a coral reef, a living wall rising up from the sea bottom, built through a million of years by generations of coral animals. Cream, vermilion and dull gold, it shone through the clear water.

But the cow cachalot, having no imagination, was not interested in the kaleidoscopic beauties of the reef, and the fish she saw beneath her were too small a fry to merit her pursuit. One tiny fish, however, floating insinuatingly near to look the newcomers over, irritated the leviathan to the point of combustion. The inquisitive one was a chubby, flat-bodied fish no more than two feet long, with impudent moon eyes, and he looked untrustworthy, to say the least. His sides were marked with bright transverse bands of blue and gold, which camouflaged his passage through the sunshot water to a remarkable degree. He went by the name of the pilot fish in those waters, an innocent name for the trade he plied, for he was the jackal of the sea. As the huge cachalot turned on him with a lunge, he disappeared into the depths in two incredible darts. The monster, in dignity, refrained from pursuit.

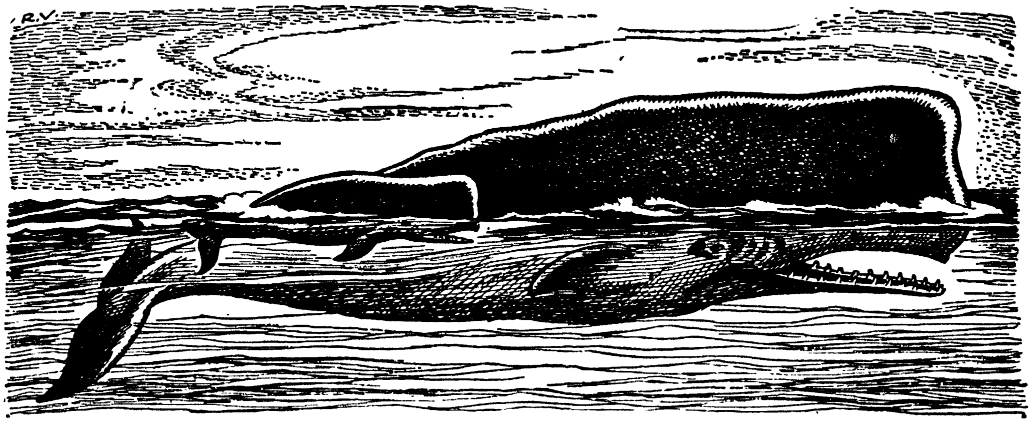
Presently, however, a long shadowy form, pale gray and dappled with green, came shooting along at amazing speed some twelve fathoms below her, with the undulating movement of a snake. Here was game to pique her stupendous appetite. Instantly she turned over, and with no sound save the low sucking of closing waters dived with the speed of a torpedo released from its tube. What she had glimpsed was an oar fish, one of the strangest dwellers of the sea. He was boneless as an eel, and he propelled himself by means of two long ventral fins shaped like a ship's oars, from which he derived his name. His speed, already stupendous, seemed to redouble at sight of the swooping shadow of the cachalot. But it availed him not. Within a hundred yards the great cow engulfed her quarry in her cavernous saw-tooth jaws.

As she was snapping over this luscious meal, she was interrupted by a swooping bank of shadows that descended upon her like a flock of crows. They were a band of small "killers," those fierce dolphin-whales that hunt in packs and are the terror of the seas. Five in number, they had been in hot pursuit of the oar fish, following along the water currents left by the big fish's passing, plainly marked as a trail to their acute senses. Their little eyes glowed with a fierce, voracious light, and on the back of each a sinister dark dorsal fin was upraised, the black flag of the true pirate, for all killers are pirates.

At sight of the huge stranger from the North, however, they back-watered on the instant, then darted to the attack in a concerted rush, meant to overwhelm. But never before had it been their lot to do battle with a cachalot whale. Wolves of the sea though they were, their ferocity was daunted, their morale completely broken in the space of a minute by the cow cachalot's furious tactics. Straight in among them she rushed, darting, doubling, her huge double-edged teeth working like mowers. It was ferocity, not courage, that was the keynote of these twelve-foot killers, and with the death of the first of their number the band turned tail and fled, leaving the furious cow to retrieve her unfinished meal.

When she rose to the surface again, her vast appetite was still not wholly appeased, for sea dwellers are driven by a hunger that no earth creature ever knows. So as the afternoon progressed she still cast a keen eye downward, where the fierce sun penetrated the water to an amazing depth. Far, far down in the greenish obscurity a pallid, trailing form went sidling across her range of vision about mid-afternoon. And once more the cachalot dived.

What she had seen this time was a devilfish, which had ventured up from the rock grottos at the sea bottom wherein he dwelt, doubtless on a hunting foray. But he was much farther down than the cachalot had judged. In fact, what she had mistaken for a large eight-armed squid, such as she was in



For a time mother and son floated lazily on the warm surface of the smiling noonday sea.

the habit of hunting, was one of the giant devilfish of the tropic seas, which live in the uttermost abysses at the ocean floor, three miles deep, and rarely, if ever, come to the surface.

This one was a giant of his kind. His mighty tentacles were as big around as flagpoles, each of them thirty-five feet long. They sprouted like the stalks of a turnip from a bleached and bulbous body fully as large as that of the cachalot, and shaped like a Zeppelin. The center of this grisly mass was a gaping, senile-looking mouth with an overhanging, parrot-like beak, on either side of which glared two lidless eyes of awful and appalling blackness.

At sight of the whale swooping like a bullet upon him, this livid horror sank plummet-like into the depths from which he had come. Though bulking far larger than the cachalot, the great devilfish was not one to attack any creature too large to be engulfed in his insatiable maw. His snakelike arms gathered into a cluster and trailing out behind him, his body elongated, he shot downward in a series of horrid lunges, sucking in great volumes of water in the propulsion sack beneath his tentacles and spewing it forth behind him, blowing himself along by the sheer power of his obscene spitting.

Undaunted by the size of the monster, the grimmest, most fearsome of all the forms that live in the sea or upon the dry earth, the cachalot shot downward in pursuit. Four hundred and fifty fathoms, and the pressure became great enough to have crushed in the hull of a stout ship. The whale taxed all the strength of her mighty flippers to forge down through the growing density. The strain told on her, but her huge cylindrical body was solid as reinforced concrete and built in an egg-shaped design for just such a purpose, its vital parts, the brain and the little eyes, set deep in protecting bone.

Just before she reached the six-hundred-fathom level beyond which no mammal may descend, the cachalot succeeded in closing with her foe. Her trap-like jaws closed on one of the flowing streamers and held with bull-dog tenacity.

Two tentacles, covered with round sucking discs, studded with black curved claws, wound simultaneously around the cachalot's head in an attempt to crush shut her snapping jaws. Almost, he succeeded; only the amazing agility of the cachalot saved her. Revolving her body like an auger, and working her jaws like saw-edged shears, she was able to lop off another portion of an arm before the fatal double coil could be achieved. But wherever the death-pale streamers clutched at her sleek body, the blood sprang, dyeing the water red, while the pallid blood of the devilfish filled the whole vicinity with the sickening reek of musk.

Tentacle after tentacle, as if with an intelligence of its own, clutched at the cachalot from all angles, seeking to overwhelm her, while the monster's eyes flamed like black pools of hate.

Far above, in the sparkling pristine sunlight that masked so perfectly the terrors of the depths, the cachalot calf swam nervously about over the spot where his mother had disappeared.

Then there drifted on the scene the same small striped fish of the morning. He was about his dark business, which included a close-up view of the cachalot calf, but the calf would have none of this. With baby fury he rushed the intruder and drove him once more to the depths—a true son of his mother.

Now the thing was done. Romero, the pilot fish, was speeding in toward the reef, to find the grim master for whom he worked. He was the bearer of great tidings, of the mighty battle in the depths and the cachalot calf left all alone.

He was not long gone. In a curve of the outer reef, where the island shore fell away to plumbless depths, a huge gray sinister shape lazed in a sheltered cavern amid the rocks, nose pointing out to sea like a dirigible at its moorings. It was a great, slate-gray, thirty-five-foot shark, ill-tempered, pig-eyed and half blind. He was one of the species dubbed, through many a shuddery experience, "gray nurse" by men of the islands, and he had been acknowledged master of these surface waters for a thirty-mile radius for more years than any sea folk could recall. He was a lone shark, which, by the way, implies that he was a misanthropist as well as a cannibal. Others of his kind that had inhabited these waters, he had either eaten or driven away.

Presently as he lazed and basked, his near-sighted eyes made out a tiny fish moving back and forth in the cavern opening. It was Romero, the pilot fish. What sort of communication passed between the two can only be conjectured, but presently the gray monster was seen sliding away in the wake of his strange little convoy. How this cheeky fish dared swim with impunity but a few feet above the hammerlike snout of this devil of the deep is a point you may question. The only answer is that there is socialism of a sort throughout all nature. The pilot fish has followed the shark for ages on the chance of left-over scraps from the monster's killings, and from this the wily fellow doubtless has learned in time to scout out game for the grim preyer.

About this time the battle of the cow cachalot in the depths had come to an end. For over forty-five minutes she had been locked in desperate conflict, exerting all her mighty strength. Her great heart was pounding to the bursting point, and she had called upon her last resort, the mysterious store of oxidized blood whales carry in the dorsal arteries along their spines, long before the tide of battle finally turned. The devilfish never knew how near he had been to victory, and never would he have known. The cachalot would have gone on grimly to the death before giving in, for, once the battle madness was on her, life meant no more to her than did the ooze of the sea bottom.

All at once, when it seemed she could stand the strain on her lungs not a moment longer, the deathly grip of the enemy had suddenly relaxed, and in an instant the devilfish, or what was left of him, was lunging away in desperate flight. His nerve was completely broken, and as he fled he squirted forth from a gland beneath his tentacles a jet of inky fluid which colored the water round about like a black smoke-screen, veiling his flight. It was his flag of defeat.

The cachalot, too, was of the opinion that "enough is plenty" and made no move to pursue him. Her lungs close to breaking, for she could no longer breathe in water, fish-fashion, having no oxygen left with which to aerate it, she shot like a bullet toward the surface, propelled by all the pressure of the depths and the power of her vast flukes. Her speed was such that her body shot clear into the sun-lit air and fell back to the surface with a resounding splash. Thereafter for two or three minutes she lay heaving and exhausted, drawing in vast quantities of the blessed, life-giving air, while her calf came nosing about her filled with concern.

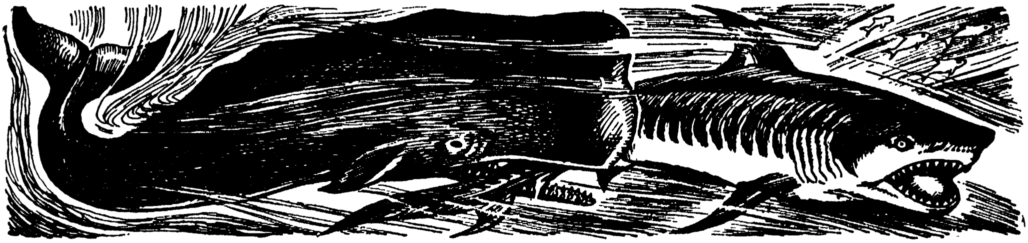
And then it was that the sword which hangs low over all the dwellers of the deep descended once more upon the she-cachalot, catching her before she had nearly recovered her powers. Out from the reef came swimming the diminutive striped pilot fish, straight toward the basking place of the two whales. And behind him, looming dimly through the translucent water, appeared the fearsome gunmetal bulk of the man-eater.

Ten rods away, the pilot fish, the cause of this meeting, swerved and went sidling away from the danger area, there to hang about in the offing like the true carpetbagger he was.

The shark, as has been said, was dull of sight. His eye fell first on the cachalot calf. With a fierce rush he bore down upon the youngster, but even as he turned over to bring his ugly undershot jaws into play a great shadow bulked suddenly between him and his prey. In sheer astonishment the tiger of the deep swept aside in a great arc and turned right side up to stare. Not till then was he aware of the cachalot cow's existence, for the pilot fish, you may be sure, had neglected to mention her.

For a few tense seconds the two monsters hung motionless, surveying each other through five rods of water, their baleful eyes loaded with sudden hate and death. Each saw in the other a deadly foe, from whom no quarter could be expected, but in neither was there an instant's indecision.

The shark's ugly mouth, a sneering gash under his head, revealed rows of cruel teeth, ready to rend the whale's bulk to ribbons. Never before had he faced such a powerful foe. Motionless as a dead thing he waited, but every sinew in his powerful bulk was tense and alive, waiting for the moment to strike.



At last the cachalot's jaws met in the pirate's spine—and that spelled the end for the shark.

The cow cachalot was fully aware that the moment she had most dreaded through life was upon her at last; here was the real enemy—the grimmest pirate of the upper-waters—and he must be faced at once, in spite of wounds and exhaustion. In the deep there is neither rule nor ruth of combat; the fittest alone survive, the weakest perish, and that is all there is to it.

Huge though he was, five feet longer than the cachalot herself, the shark was in a degree appalled at the suddenness and savagery of her rush. Turning on his side, he avoided a head-on clash. Keeled half over, his triangular many-toothed jaws agape, he lunged downward directly beneath the whale, gashing her flank in passing, and ripping away a huge mouthful of hide and fat. Simultaneously the cachalot tore away a mass of flesh from the enemy's livid-white belly. But the wounds were scarcely felt by either in the fury of the moment.

The struggle that then ensued was, so far as human eyes could have followed, like a maelstrom churning the face of the sea—but it was a battle royal such as those waters were not likely to see again in many a year. Fighting jaws that gleamed white as bone slashed and snapped; the water was flung yards high, and turned slowly from green to dull red from their bleeding wounds. Agile as any fish for all their size, the two were even swifter, and fought with a deadly craft, like skilled duelists, soundless, except when they lunged to the surface in their feintings. The soft green of the sea surface that had all day lain empty and languid became terror-ridden with whipping bodies and malevolent eyes that gleamed like phosphor. Each was keen for the death grip once the right moment arrived.

Locked finally together, the two bodies shot downward into the dark depths where only the faintest daylight filtered, spinning like twin propellers. Exhausted as she was and outclassed as to weight, the cachalot yet had this advantage in the combat. Hers was the greater intelligence; also, she did not need to turn over as did the shark to bring her jaws into play. But her initial fury drove her beyond all prudence. Like the ripping of monstrous shears the teeth of the gray nurse tore for a third time at her exposed belly, before she was able to seize her chance. Doubling violently before the shark's teeth tore loose, she caught the base of the monster's tail in her immense jaws, and there she held with all the tenacity of her fighting nature, cutting in and in with her keen-edged teeth.

Thereafter, so far as anything like a duel was concerned, the battle was ended. For twenty minutes more there was a mighty lashing. The shark dived fifty fathoms and lunged to the surface again. He twisted and snapped, but in vain, for the cachalot had become but an extension of himself and his very efforts but aided her agility to elude him, while her own jaws worked relentlessly and unceasing. At last they met in the pirate's spine—and that spelled the end, for the shark, now minus a rudder, was shorn of strength and speed. Well he knew it, for when the cachalot's jaws relaxed, he made no attempt to renew the fray, but went ploughing cumbrously and with awkward flounderings toward the safety of the reef. Once more it was the fiery courage which alone has made the mammal kind rulers of all the earth that had won for the she-cachalot over the cold-blooded ferocity of fishlike things. For a hundred yards or more the great cow pursued him, but she was not of the petty breed that hectors a beaten opponent long. Quickly she left off and swam slowly back to snuggle and quiet her excited calf.

But there remained still one more trial to test the mother whale's irritable temper that day. Round about her as she rested the blood-stained waters became suddenly alive with darting schools of fish, voracious little scavengers of the depths whose trade it was to watch for strife and tragedy. Their acute and marvelous senses had been drawn from afar by the battle and the taint of blood, and they were swarming up to fatten on the spoils. Perhaps they deemed the cachalot dead or dying, for some bold spirits actually rose to tweak and tug at her bleeding flanks with hungry jaws. That was too much. Once more, and for a third time, the cachalot's little eyes combusted. Thrusting her calf aside, she sprang from rest to full speed in an instant. Then back and forth through the gleaming schools of the tormentors she darted, her cavern mouth sucking them in by the barrelful. Some of them she swallowed, others she spewed forth and left dying and mangled on the surface.

Among these latter, as the horde of scavengers was put to rout, one tiny fish with a golden transverse band, lay bitten quite in two, flapping its life away—all that was left of Romero, the pilot fish, Judas of the deep.

Presently the face of the sea grew quiet again. The tainted waters cleared, and the cachalot and her calf floated lazily on the surface as the afternoon waned. When the little one had nursed and the mother had regained her powers to a degree, the pain of her wounds, which were many and grievous, seemed miraculously assuaged by a sense of boundless content.

ICARUS AND HIS WAXEN WINGS

A Legend of Ancient Greece

The airplane is one of the wonders of the present age, but dreams of flying through the air are as old as early mythology. King Minos of Crete had in his service a skillful workman named Dædalus. Dædalus built the famed labyrinth for King Minos, but soon afterward he lost the royal favor and was thrown into prison. He made his escape, but could not leave the island, as the king had all departing vessels watched.

The workman was doubly anxious to escape, as his young son Icarus was with him. He decided to make wings for himself and his son. After inspecting the wings of many birds he took a quantity of feathers and bound them together in the shape of wings. The larger feathers he tied with thread and the smaller he secured with wax. Icarus watched his father with interest and collected the feathers when the wind blew.

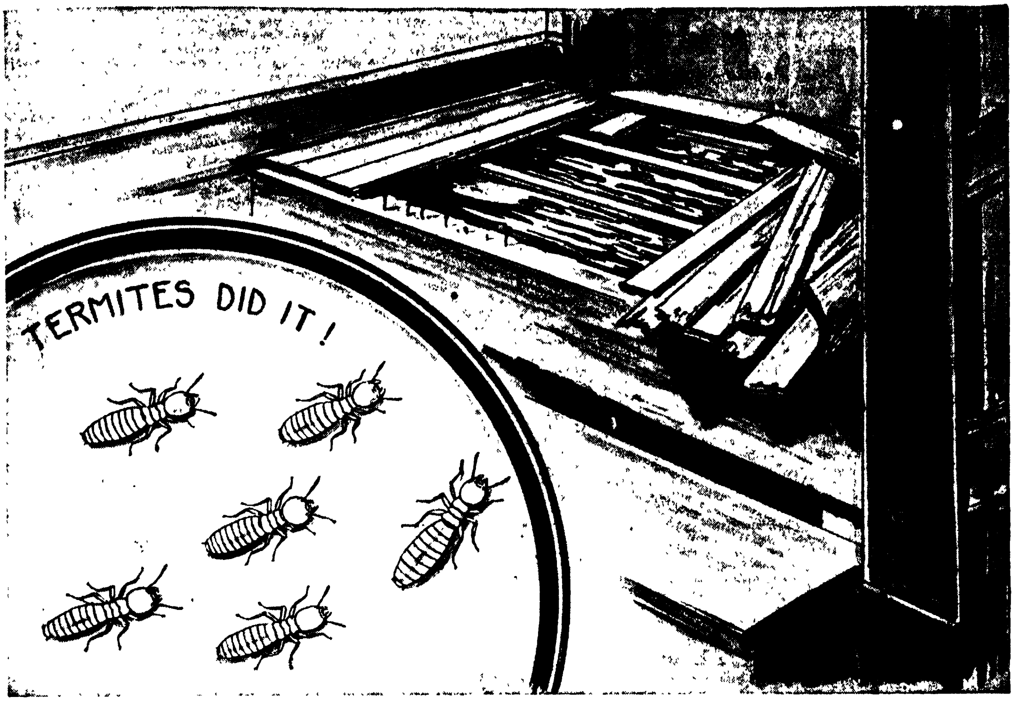
When the work was finished Dædalus fastened the wings on his shoulders, and by imitating the motions of a bird he found himself poised in the air high above the earth.

His next step was to teach Icarus to use the wings. The boy learned quickly, but he was impatient to fly faster and higher than his father would permit.

All was ready for the flight. Dædalus warned his son not to fly too low, as the damp would clog the feathers, nor too high, as the sun would melt the wax.

Shepherd and plowman watched in astonishment as the pair rose in the air. On they flew, past Samos, Delos and Lebinthus. But Icarus, exulting in his power, soared upward as if to reach the heavens. The blazing sun softened the wax. Down plunged Icarus, to be drowned in the blue Ægean Sea. His body was buried on an island which is called Icaria to this day.

THE NEXT STORIES ARE ON PAGE 6941.


TERMITES DID IT!

A glimpse of the destruction caused by termites. They gnaw their way through wooden structures of all kinds.

INSECT FOES OF MAN

TERMITES, TRUE BUGS AND RELATED FORMS

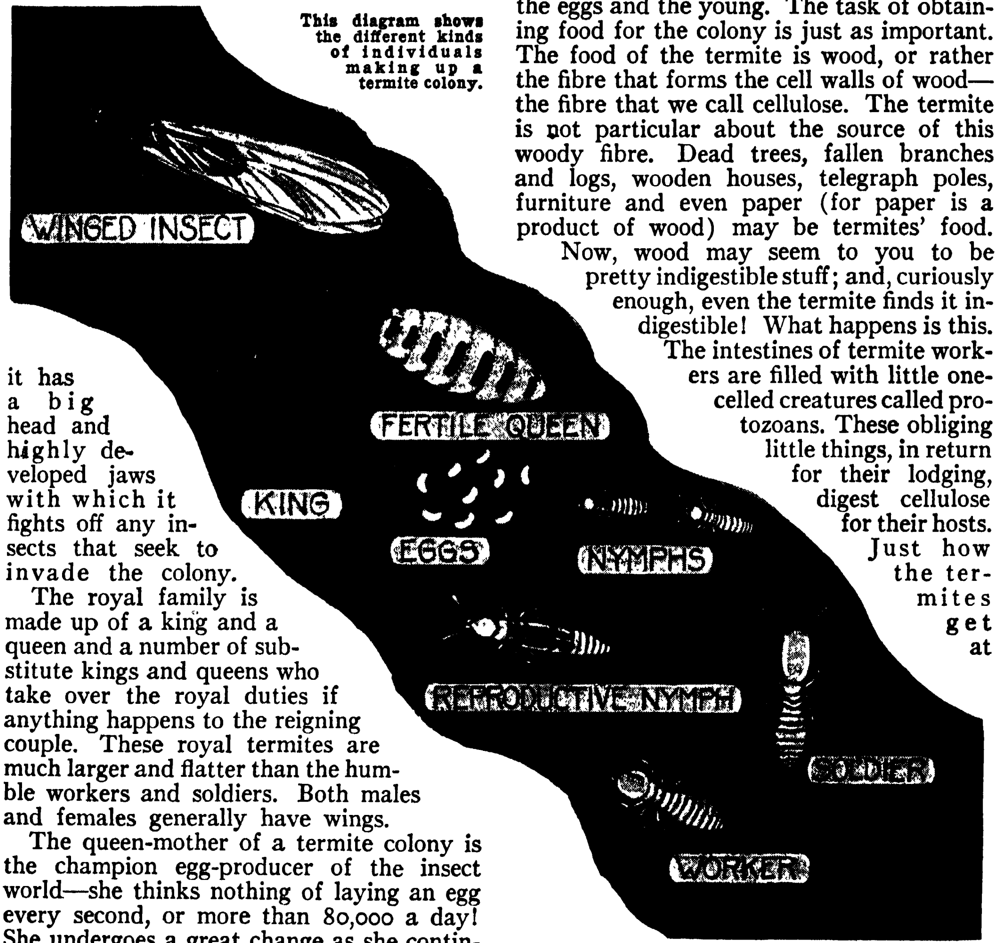
IN other articles we have already told you about certain insect foes of man, such as mosquitoes, flies and various kinds of beetles. The termite is another insect that must be reckoned as an avowed enemy. Though it is sometimes known as the white ant, it is not really an ant. However, the two insects resemble each other somewhat; besides, like ants, termites live together in great colonies.

Termites belong to the order of the Isoptera (ih-sop′-ter-ah) or equal wings; the name comes from the fact that winged termites have two pairs of wings, more or less alike. Termites are to be found in great numbers in the tropics; they are also fairly common in certain temperate regions of Europe and North America.

The dwelling-places of these insects are really amazing structures. In Africa termites often raise mounds to a height of twelve feet or more. These mounds, incorrectly called ant hills, consist of earth particles, cemented together with saliva; yet they are so solid that they can easily support the weight of a man. There is nothing on the outside of the mound to indicate that there is anything unusual about it. But if we could look inside, we would see a maze of tunnels and chambers; we would also see swarms of small insects rushing busily hither and thither.

Not all termites raise mounds. Some of them make their nests, as large as barrels, on the outside of living trees, plastering the trunks with chewed wood pulp or earth. Others live inside the hollow trunks of dead trees. Still others (including most of the species to be found in North America) build their nests underground.

The termite colony is made up for the most part of workers and soldiers—male and female insects that never fully develop and that can not reproduce their kind. The worker is an ugly little insect, about a quarter of an inch long; its soft abdomen is a dirty white color and the rest of it is brown. It does all the work of the colony; it builds the nest, it collects food and attends to the royal family and to the young termites. The soldier is somewhat larger than the worker; it has a big head and highly developed jaws with which it fights off any insects that seek to invade the colony.



This diagram shows the different kinds of individuals making up a termite colony.

The royal family is made up of a king and a queen and a number of substitute kings and queens who take over the royal duties if anything happens to the reigning couple. These royal termites are much larger and flatter than the humble workers and soldiers. Both males and females generally have wings.

The queen-mother of a termite colony is the champion egg-producer of the insect world—she thinks nothing of laying an egg every second, or more than 80,000 a day! She undergoes a great change as she continues her egg-laying duties. Her abdomen swells and swells until finally it has the size and shape of a fat sausage; it is sometimes six inches long. Since the head and legs of the queen undergo no change in the meantime, it is clear that the poor thing is no great beauty.

As each egg appears, it is carried off by a worker and deposited in one of the nurseries of the colony. The eggs develop into quaint little insects, complete with head, feelers and legs. They are helpless little creatures. They remain in their nurseries, carefully tended by the workers, until they are old enough to take up their duties in the colony. Some of the young turn out to be workers and soldiers; others, members of the royal family.

You can see that it requires the activities of a small army of workers to take care of the eggs and the young. The task of obtaining food for the colony is just as important. The food of the termite is wood, or rather the fibre that forms the cell walls of wood—the fibre that we call cellulose. The termite is not particular about the source of this woody fibre. Dead trees, fallen branches and logs, wooden houses, telegraph poles, furniture and even paper (for paper is a product of wood) may be termites' food.

Now, wood may seem to you to be pretty indigestible stuff; and, curiously enough, even the termite finds it indigestible! What happens is this. The intestines of termite workers are filled with little one-celled creatures called protozoans. These obliging little things, in return for their lodging, digest cellulose for their hosts. Just how the termites get at the prepared cellulose is not clear. Either they digest certain substances secreted by the protozoans or else they digest the protozoans themselves.

The workers, which alone collect food, bring wood pulp to the soldiers, who also have protozoans in their intestines. The members of the royal family, however, are not provided for in this way. Hence they must be fed by the workers on cellulose that has already been digested by the protozoans and has passed out of the workers' bodies.

Termite workers and soldiers always serve in the colonies in which they were born. The young princes and princesses of the royal family, however, often leave the home nest in order to found colonies of their own. One fine day, when their wings are fully grown, they all fly off together up into the great mysterious world of the open air that they have never known.

They are at once attacked by a cloud of enemies. While they are on the wing, they are snapped up by birds and flying insects; when they alight, snakes and rats and beetles feast on them. However, a few couples manage to escape with their lives. They bite off their wings and then settle down in a home of their own. The queen begins to lay eggs; soon the young begin to fetch food for the king and queen and they gradually build up the nest. In time there is another flourishing termite colony.

Of course the food-getting activities of termites make them disagreeable neighbors of man. As long as the termites are content to feast on dead and rotting logs, they do us no harm; in fact, they are quite useful for they serve to clear the forests of rubbish. But when they attack our houses and our belongings, that is a different story.

TERMITES ALWAYS TUNNEL AWAY BENEATH THE SURFACE

The worst of it is that the workers shun the open air, since it is likely to dry up their delicate bodies. Hence they keep tunneling away beneath the surface. There is no way of telling how far gone a termite-infested chair or bureau or floor-timber may be. In tropical countries, where termites are particularly active, a house that seems to be in perfect condition may collapse for no apparent reason. Only when we examine the timbers and beams do we find that the termites have reduced them to nothing but hollow shells.

The most active measures must be taken to hold termites in check. One of the most effective of these measures is to treat timbers and woodwork with certain chemicals; termites will not attack wood that has been treated in this way. Sometimes a metal sheath is placed around exposed timbers by which the insects might penetrate into a house. But, in spite of all our efforts, termites still cause great damage every year.

We now come to the great order of the Hemiptera (heh-mip′-ter-ah) or half wings. This order includes the true bugs, among other insects. Now, many people use the word bug when they refer to almost all insects that creep or walk or run—beetles, cockroaches, ants and so on. This is an inaccurate use of the word. Strictly speaking, "bug" refers only to certain insects (not all insects) that have beaks fitted for piercing and sucking and that an take only liquid food. Chinch bugs, squash bugs, tarnished plant bugs, bedbugs and water boatmen are all true bugs. Beetles and cockroaches and ants do not suck their food, but chew it; they are not bugs.

Why is the general order to which the true bugs belong called the Hemiptera or half wings? You see, each of the front wings of many members of the order, including most true bugs, appears to be divided in halves. The part nearer the body is so thick that one can not see through it; the rest of the wing, however, is quite transparent.

THE INSECTS THAT ARE SOMETIMES KNOWN AS HOMOPTERA

Certain members of the Hemiptera group do not have wings of this sort. The wings of such insects as the cicada, the plant-louse and the scale insect have the same thickness throughout. For this reason, they are sometimes called Homoptera (hoh-mop′-ter-ah) or same wings. In fact, some people think that these insects, which are not true bugs, should be put in a separate order all by themselves. However, since the cicada and the plant-louse and the scale insect are all sucking creatures, the general practice is to include them in the order of the Hemiptera.

A great many of the land insects of the Hemiptera are decided enemies of man. One of the worst of these pests is the little aphid (also called the aphis and the plant-louse), which ranges in length from about a sixteenth of an inch to rather less than a quarter of an inch. The aphid has a soft, round body, which is white or pink (sometimes darker) in color. Some forms are winged, others wingless; some are produced from eggs, others are born alive from the body of the female.

The aphids live in dense colonies, made up of thousands upon thousands of individuals. The fertility of this little insect is almost unbelievable. It has been estimated that if all the descendants of an aphid survived and produced other aphids for ten generations, the tenth generation would weigh more than 500,000,000 men!

The aphid lives only to eat. It fixes upon the leaves, stems and blossoms of plants; it pierces the tissues with its beak and

ROUND THE YEAR WITH THE CORN-ROOT APHID

1. Fields of corn are often ruined by the corn-root aphid. In January, February and March, in the nests of the small brown ant we can see piles of the eggs of the corn-root aphid.

2. On warm days ants bring the eggs to the surface so that they may receive the air and benefit by the warmth of the sun. In very cold weather they carry them farther down into the unfrozen earth.

3. In April and May the eggs hatch out, and the ants carry the young aphids to the roots of the smartweed and foxtail grass. By the end of May the aphids begin to produce young, both winged and wingless.

4. As soon as the corn plants are growing the brown ants carry the aphids to the roots, bringing to them even the winged variety. All through the summer the aphids produce young.

5. All summer the ants attend the aphids, burrowing round the roots of the corn and carrying the pests from plant to plant. In return the aphids furnish sweet honeydew. The ants stroke the insects with their antennæ, thus milking them as cows are milked. All this time the aphids are multiplying. An aphid produces eggs eight days after it is hatched.

6. Each generation takes about 16 days, and there are 12 generations in a season. If all lived, there would be next spring nine-and-a-half million million aphids, forming a line 7,850,000 miles long.

7. Aphids born in the summer are winged or wingless females, but in September wingless forms are born which develop into ordinary males and females. These females lay the glossy eggs mentioned above.

greedily sucks up the sap. Its appetite is enormous. It feeds and feeds and as it does so, it grows plumper and plumper. At the same time a sweet, sticky substance called honeydew begins to ooze from the hind part of its body.

Aphids attack many different kinds of plants—roses and other flowers, fruit trees, vines, corn, potatoes, cabbages, beans, hops and many important timber trees. A single aphid is so small that it could do no harm worth talking about. A colony of aphids, however, if left free to develop, would drain the life out of the vegetation of an entire countryside.

Fortunately for us, the aphid, one of the most defenseless of creatures, is a prey to many enemies. To these enemies the little insect, simply dripping with honeydew, is like a delicious bit of chocolate on the hoof, so to speak. Birds gobble aphids up by the beakful; ladybirds love them; the larvae of lacewings feast on them; parasites grow and thrive in their bodies.

The ranks of the aphids are constantly thinned by these enemies. They are thinned also by man, who wars against them by spraying growing plants with nicotine. Yet new generations of aphids are continually born and it is with the greatest of difficulty that they are held in check.

The aphid has one defender in the insect world—the ant. This insect has a sweet tooth and is particularly fond of the aphid's honeydew. Instead of killing the aphid, the ant keeps the meek little creature alive and "milks" its honeydew from time to time. We tell you about the extraordinary relationship between the ant and the aphid on page 6353, in our chapter on ants.

THE SCALE INSECT—ONE OF THE TINIEST AND MOST DESTRUCTIVE OF ALL

The scale insect is another destructive creature. If you saw a colony of these tiny insects upon a fruit, you would not know that they were insects at all. They would look like a lot of spots or scales, each about as big as a pinhead. Even though these spots are alive, you would not see them move. This is why.

Soon after the scale insect is hatched, it leaves its birthplace and begins to wander about, looking for a likely place to settle down. It finds this place at last upon a stem or a leaf or the outside of a fruit. It inserts its sharp little beak in the tissue and then settles down for a lifetime of sucking at this particular spot.

It is soon covered by a substance that it secretes or gives forth from its body—a substance that in certain species looks like wax, in others like cotton, in still others like powder. The growing insect sheds one skin after another; these skins form a rounded little scale, held in place by the secreted substance.

The scale insect is so small that a fairly large colony sometimes develops before the presence of the insect is suspected. Because it is so small, too, it is apt to stow away, unnoticed, on fruit trees and other plants that are shipped long distances. Once it establishes itself in a community, it spreads very rapidly.

Fortunately man has found a faithful little insect ally in the constant war that he must wage against the scale insect. Some years ago, scale insects from Australia were accidentally introduced into the great fruit-growing districts of California. They thrived in their new home and they spread like wildfire. Nothing seemed to be able to hold them in check; the entire fruit industry of the state seemed doomed.

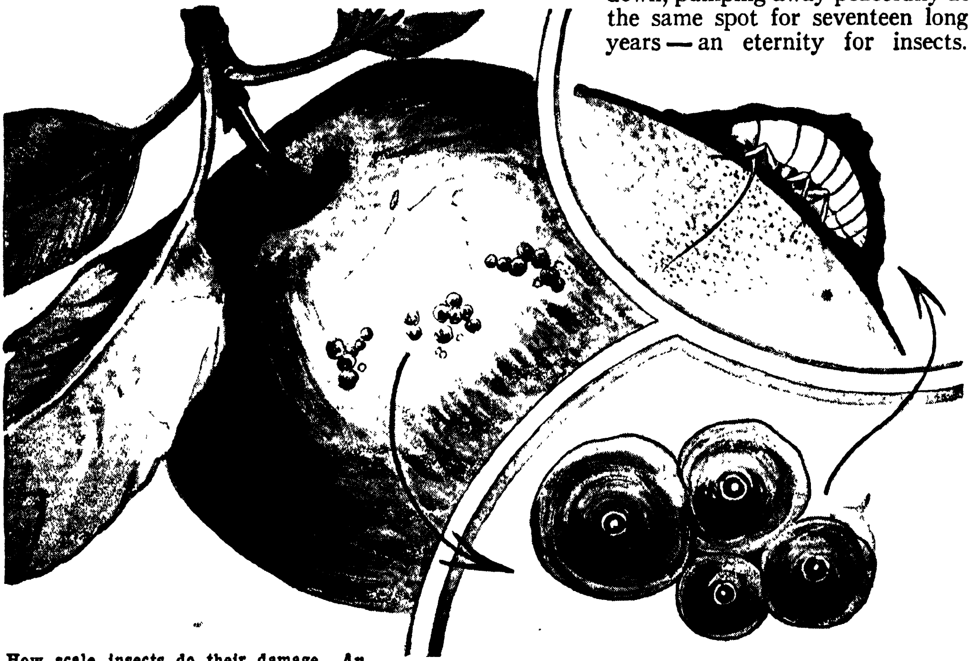
THE LADYBIRD—A FAITHFUL ALLY OF MAN IN THE FIGHT AGAINST THE SCALE INSECT

Now it was known that these tiny pests did little harm in their Australian home. American scientists went to that island-continent to find out why this was so. They found that the scale insects were kept in check because they were gobbled up in great numbers by the ladybird, a beautifully spotted little beetle. Numbers of ladybirds were carried to America, bred in great numbers and then set loose in the orchards. They did a remarkable job of cleaning out the scale insects; in two years or so the pest was under control.

Since that time the United States Government has kept a constant supply of ladybirds on hand. When scale insects threaten in any part of the country, the little ladybird policemen are rushed to the spot.

There are a few species of scale insects that man has found useful. The *Coccus lacca,* a scale insect of the Far East, gives out a resin-like substance; this is made into shellac, used for varnishes, sealing wax and phonograph records. A beautiful red dye, called cochineal, is made from the dried body of the *Coccus cacti,* a scale insect that is often found on plants in Mexico and Central America. (Today cochineal has been largely replaced by a dye made from coal tar.) However, the benefits brought to man by the useful scale insects are more than offset by the harm done by the destructive species.

One of the most remarkable of all the Hemiptera is the cicada. One species, the seventeen-year cicada, is the longest-lived insect known to man. It is a fairly large black insect, with four transparent wings and bright orange legs; it feeds on vegetation. The male produces a shrill song by means of a pair of drum-like organs on the underside of the abdomen. Each of these organs is really a hole, covered over with a tightly stretched membrane. A muscle connected with this membrane causes it to vibrate rapidly and this produces the sound.



How scale insects do their damage. An apple attacked by these wee insects shows only a considerable number of tiny rounded scales, as here. Under each one of the scales, however, an insect is busily sucking away at the fruit. It never moves away from this particular spot.

The female of the seventeen-year cicada does not sing. "Happy are the cicadas," said a Greek sage in days of old, "for their wives are voiceless." Perhaps the female cicada is too busy to sing! After all, it must get on with the important task of laying eggs. It makes gashes in the twigs of trees with its ovipositor (egg-placer), an organ at the end of its abdomen; it then lays its eggs in the gashes.

The young cicadas that are hatched from the eggs do not remain long in the place of their birth. They drop to the ground and begin to burrow in the soil. When they come to the root of a tree, they begin pumping away at the sap. Here they settle down, pumping away peacefully at the same spot for seventeen long years — an eternity for insects.

At the end of that time, toward the end of May, they all begin to make their way up to the surface of the soil. As they come out of the ground, the dirt is pushed up around the holes in the form of little chimneys. The insects now climb on all the trees and shrubs of the neighborhood. The old skins crack and slowly fullgrown cicadas make their way out of them. The empty skins are everywhere to be seen; they are known as "ghost bugs."

Since the cicadas appear in swarms, they can cause considerable damage to trees and to crops alike. Formerly, indeed, they were as greatly dreaded as the locusts about which we tell you in another chapter of The Book of Knowledge. In fact, they were often called seventeen-year locusts—a most inaccurate name.

Many of the wooded areas where the cicadas used to breed have now been given over to cultivation and as a result the insects are not nearly so numerous as they used to be. The cicada is no longer regarded as a particularly dangerous pest. The damage it does is not great, compared to that caused by the plant-louse and the scale insect.

Certain cicadas, belonging to the same species as the seventeen-year kind, appear once every thirteen years. The seventeen-year cicada flourishes in southeastern Canada and in the northeastern part of the United States; the thirteen-year cicada, farther south. Both of these groups are called periodical cicadas because they pop up at certain definite times or periods. The cicadas appearing in any one year are called a brood. We can tell in advance in what year and, roughly, in what places each brood will appear.

The periodical cicadas are the most remarkable members of the cicada family; they are to be found only in North America. Other species, which take far less time to develop, are found in many other lands. A comparatively short-lived cicada is the harvest fly; it takes two years to develop. This is a black-and-green species which appears in midsummer and produces its shrill notes in the daytime from its perch on the branch of a tree. There are two broods of harvest flies, which means that every year has a brood.

Young cicadas making their way up to the surface of the soil after remaining underground for many years. At the right we see the dirt "chimney" made by the insect.

We have not space here to tell you about the other members of the Hemiptera family that devour our crops—the chinch bug, the squash bug, the tarnished plant bug, the harlequin cabbage bug and a host of others. From our point of view they are detestable little creatures and we must fight them with sprays and powders and fumigation.

There is another bug of the Hemiptera group that scorns the fruits of the field and is satisfied only with human blood. This is the bedbug, a most disagreeable insect. It is a small, rust-red creature, with a broad, flat and wingless body. It is provided with a long, slender beak, with which it sucks the blood of its victims. It makes its home in houses; it is to be found in cracks between floorboards, in furniture and in the mattresses and springs of beds.

The bedbug feeds so heartily that it can go for weeks or even months without food after a meal. The bite of the insect is annoying; so is its disagreeable and penetrating odor. The bedbug is most likely to be found in houses that are not kept clean;

also in old houses, with cracks in the walls and floors and with loose boarding elsewhere. Since it is apt to be carried about in the clothing, it occasionally appears in even the cleanest and most modern dwellings—not often, fortunately.

Houses that have been infested with the bugs may be freed of them by fumigation. There are other methods. Sometimes insect powder is blown into the cracks and crevices where bedbugs live. Sometimes the cracks are painted with corrosive sublimate dissolved in alcohol.

The bedbug has deadly enemies among insects. Certain species of ants prey on it; in Europe a small black ant, called the *Monomorium*, is said to clear a house of bedbugs in a few days. The cockroach is also a mortal enemy of the bedbug. Unfortunately both the ant and the cockroach are first-class pests themselves when they manage to get into our homes.

THE LOUSE, AN UNPLEASANT LITTLE INSECT THAT FEASTS ON HUMAN BLOOD

The louse, another insect that feasts on human blood, was formerly included by some people in the order of the Hemiptera. Nowadays it is generally put in a separate order—that of the Anoplura (ahn-oh-ploo′-rah) or unarmed tails. The origin of this name is not clear. It seems to refer to the fact that the louse is not provided with the tail-like part (like the sting of the ovipositor) that some insects have at the tip of their abdomen.

The louse is a small, wingless insect, with a flattened body and with short legs that end in strongly hooked claws. The irritation caused by the crawling of the insect is almost as disagreeable as its bite. The sucking organ of the louse is provided with hooks, with which it anchors itself before beginning to feed. The louse is a parasite; it spends all or much of its life about the person of a single victim, called the host. The insect never leaves the host, except to pass to another victim.

There are three species of lice that attack only man. They are most likely to be found on persons who have careless habits or who live in places where the sanitary conditions are not good. Certain kinds of lice attack animals. A given species of louse usually attacks only one species of animal.

Besides the annoyance it causes its victims, the louse spreads typhus, a dangerous fever. Since lice thrive in filth, typhus is most serious in city slums; it is also likely to break out in army camps or intrenchments, where the sanitary arrangements are rather primitive. The saying goes that more soldiers are killed by typhus than by bullets. In former days this saying was not much of an exaggeration.

There are several other insects that are known as lice, though they differ considerably from true lice and are placed in orders of their own. The bird-louse is a tiny wingless creature that lives under the feathers of birds and in the wool or hair of certain animals. It does not have a sucking beak like the true louse; it chews away at the feathers or the wool or the hair of its host. Hence the order to which it belongs is called the Mallophaga (mah-loff′-ah-gah) or wool-eaters.

Finally we have the very small book-louse, which belongs to the order of the Corrodentia (kor-oh-den′-shih-ah) or gnawers. Book-lice are destructive not only to books, as their name indicates, but also to collections of plants and insects in museums.

A pond on a hot summer day may seem to be a quiet, drowsy spot, where nothing ever happens. As a matter of fact, there are a hundred exciting dramas going on there every minute. The waters are alive with thousands upon thousands of insects, preying upon one another with never failing eagerness. The Hemiptera play a stirring part in these dramas, for there are many representatives of the order that live in the water.

THE GIANT WATER BUG, A TERROR TO INSECTS THAT LIVE IN THE WATER

The largest of all is the giant water bug, which is really a giant among insects, since it is sometimes more than two inches long. It is oval in shape and brown in color; it has four wings, which fold back along the body when it is not flying. The hind legs of the insect are very long and powerful and push it through the water at a great rate.

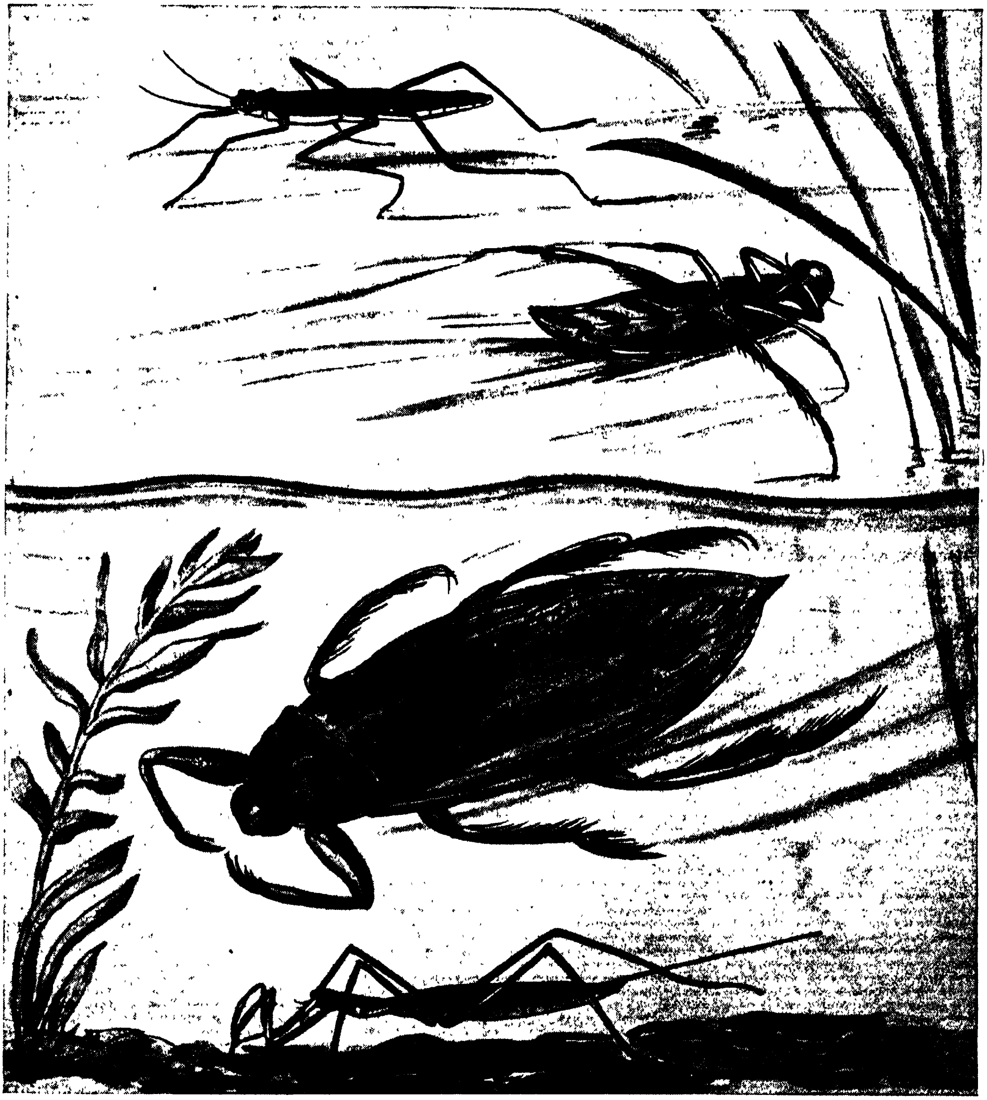
It is a terror to the insect population of ponds and rivers and brooks. It seizes its victims with its forelegs, stabs them with its sharp beak and then sucks away greedily at them. It attacks small fish as well as insects; it can kill fish larger than itself.

The giant water bug sometimes ventures out on dry land and makes for the first bright light that it sees. Perhaps you have seen it bumping again and again against a street light in a kind of frenzy. Because of this silly habit, the insect is sometimes known as the electric light bug.

The back-swimmer is another familiar aquatic insect (that is, one that lives on or in the water; aqua means water in Latin). It is shaped somewhat like a boat turned upside down; the lower part of its body is flat and the upper part is rounded like the bottom of a boat. It skims along the surface of the water by lying on its back and using its hind legs as oars.

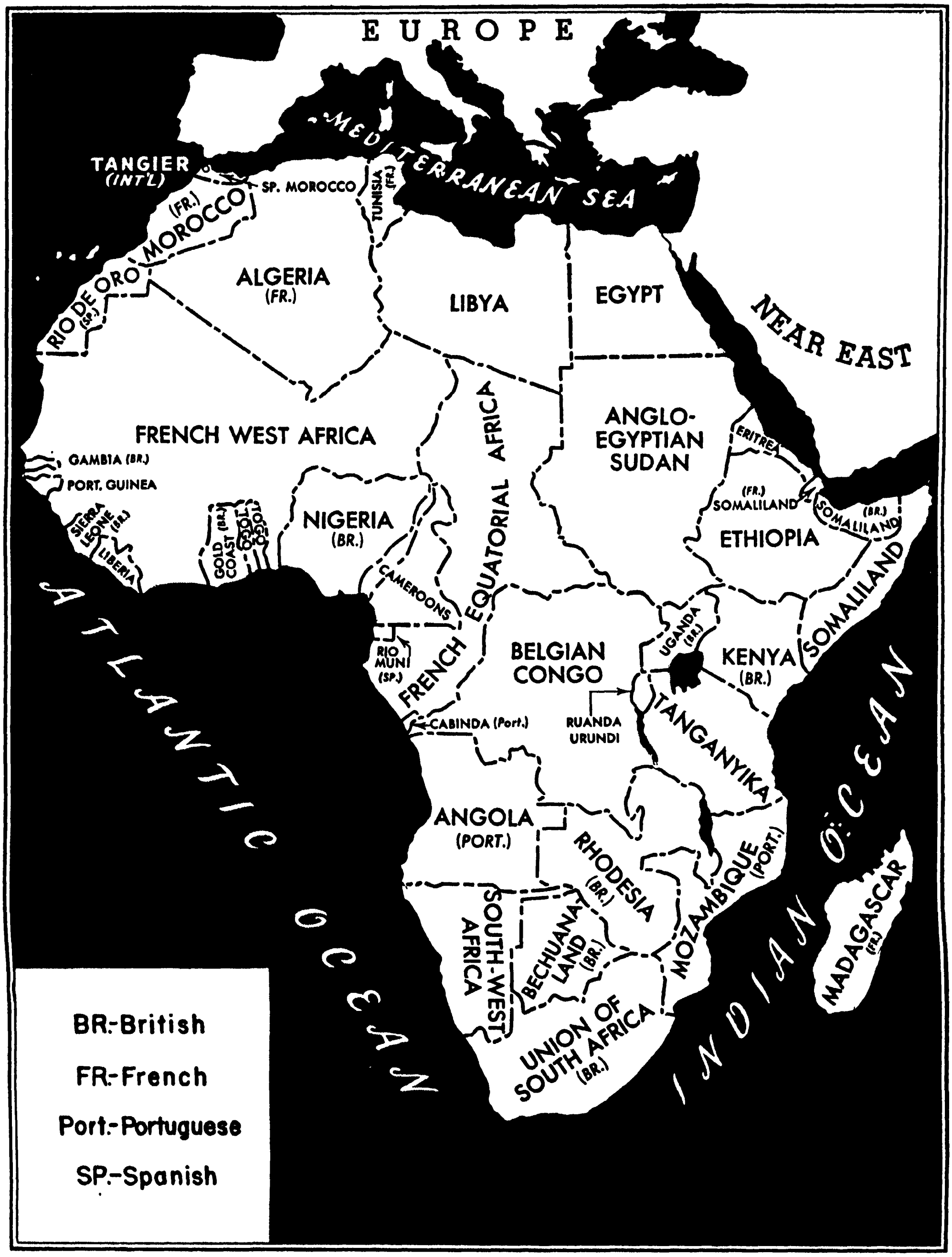
The long-legged water scorpion lives on the bottom of ponds. It moves about on its four hind legs; the two front legs are held out in front of it like claws, ready to seize its prey. The water strider (or water skater), on the other hand, prefers to remain on the surface. It has a long, slender body and six very long legs. It darts rapidly, with a curious gliding motion, over the surface, leaving tiny ripples behind it. All of these aquatic members of the Hemiptera group live on other insects.

THE NEXT STORY OF ANIMAL LIFE IS ON PAGE 6883.



A busy scene in a pond. On the surface the water strider (top) and the back-swimmer are darting this way and that. Under the surface a giant water bug is diving, while a water scorpion lurks at the bottom of the pond.

THE NATIONS AND TERRITORIES OF AFRICA



Much the greater part of this continent is under the control of several European countries, particularly Great Britain and France. There are only three completely independent nations—Egypt, Ethiopia and Liberia. Before World War I Germany also held a share; but from the end of that war until the end of World War II her old possessions were administered as mandates of the League of Nations by either Great Britain or France. They did not own the regions outright but had authority to govern. These territories—the Cameroons, Ruanda-Urundi, Tanganyika and Togo—are now trusteeships of the United Nations. It is only within recent years that Africa's wealth of resources has come to light; much greater development can be expected in the future.

Tall date-palms, that provide shade and food, in a fertile oasis at Gadames, Libya, on the Tunisian border.

HOW AFRICA HAS BEEN DIVIDED

THE map of Africa is a rather curious affair. The thirty or so political divisions of the continent range in size from vast areas of over a million square miles to tiny ones of less than a thousand. A few of these territories are independent; some are colonies; others are protectorates; still others are United Nations trusteeships; one is a self-governing dominion. To understand how all this has come about, one must know something of Africa's story.

It begins in the valley of the Nile, where there arose, some 6,000 years ago, the oldest civilization that history records—that of Ancient Egypt. The Egyptians were an extraordinary people. They were accomplished mathematicians and astronomers; they were wonderful architects and artists; they perfected ingenious irrigation systems. At one time, too, Egypt was a great military power.

By the sixth century B.C., when Egypt was overrun by the Persians, she had seen her best days. Under the Macedonian Ptolemy (died 283 B.C.) and his successors, Egypt had a rebirth of learning, if not of power. At last, in 31 B.C., the country bowed to the might of Rome and became a Roman province. We tell you more about the fascinating story of Egypt on page 807.

Another African state, Carthage, seemed destined at one time to become the ruler of the ancient world. This famous city was founded about 800 B.C., on the coast of what is now Tunisia, by the Phœnicians, a seafaring people who dwelt on the western shores of Asia Minor. Carthage was a great trading center. Her merchant ships reached every coast and island in the Mediterranean and sailed even to distant Britain. She was also a great military power. At one time she included in her domains Libya, Sardinia, Corsica, most of Sicily and a great deal of Spain.

In the year 264 B.C., Carthage came into conflict with Rome, which had already begun her career of conquest. The two powers fought three fierce wars (the Punic Wars), which extended over a period of more than a hundred years. At one time Carthage, under her great general Hannibal (see page 1196) almost brought Rome to her knees. At last, however, the Carthaginians were crushed; in 146 B.C., their great city was utterly destroyed.

The Romans gradually extended their rule over almost all of the Mediterranean coastal areas of Africa. North Africa became a thriving place; settlers went there from all over the Roman Empire. The Romans built fine roads and aqueducts as well as splendid monuments and buildings.

While the Romans were ruling peacefully in the north of Africa, Ethiopia was maintaining a sturdy independent existence. Little is known of the ancient history of this land. The story has it that its rulers are descended from Menelik, the son of King Solomon and the beautiful Queen of Sheba.

THE KINGDOM OF THE VANDALS IN NORTH AFRICA

In the fourth century A.D., the Roman Empire had been divided into two parts—a Western Empire and an Eastern Empire. In the following century, the Western Empire, which held North Africa, fell to pieces under the ceaseless attacks of the barbarians to the north. The Vandals, a Germanic people, invaded northern Africa in 429. They conquered the greater part of the former Roman possessions and set up a kingdom that lasted over a hundred years. They were overthrown in 534 by the soldiers of the Eastern Empire.

In the year 639 the Arab followers of the prophet Mohammed crossed over into Africa and by 641 they had conquered all of Egypt. They then overran northern Africa, spreading the doctrines of Mohammed by fire and sword. They never succeeded, however, in conquering Ethiopia, where many Christians had taken refuge. The Arabs called the country Abyssinia or Land of Half-breeds (the name comes from the Arabic word *habesh*, meaning half-breed). The Ethiopians naturally hated the name; however, up to a comparatively short time ago, many people in other lands insisted on calling the country Abyssinia.

In course of time, the Arab empire in North Africa split up into a number of more or less independent states. These maintained themselves successfully until the sixteenth century. In the early years of that century, the Spaniards, who had succeeded in driving the Moors from their country (see page 4915), invaded North Africa. At first they carried all before them; they seemed destined at one time to add great areas in Africa to their growing empire. They were checked, however, by the warlike Turks.

The Turks, an Asiatic people who followed the Mohammedan faith, conquered Egypt in the year 1517. They extended their possessions to the west, driving out the Spaniards and setting up regencies in Algeria, Tunis and Tripoli. These three countries, which came to be known as the Barbary States, became more or less independent in the course of time, but they remained Turkish possessions in name.

Together with the Mohammedan state of Morocco, to the west, they became the foes of Mediterranean commerce from the sixteenth century to the nineteenth. Their galleys sped all over the Mediterranean in search of prey. When they captured a ship, they seized the cargo and held the passengers for ransom. The great Christian powers, to prevent their merchantmen from being molested, were forced to pay tribute at last to these robber states.

The nations of Europe could not gain a foothold in northern Africa until the nineteenth century. They did succeed, however, in establishing themselves on various points of the western and eastern coasts of the continent. In the fifteenth and sixteenth centuries, the Portuguese, inspired by the efforts of their great prince, Henry the Navigator (see page 80), set up a number of trading posts along the coast of Guinea. (This name was applied to the West African coastal region between the Senegal River and the Orange River.) They also made settlements in Mozambique, on the eastern coast.

From the very outset, the Portuguese found their African trade very profitable. Naturally, the other countries of Europe wished to obtain their share of Africa's wealth and they, too, set up trading posts. By the end of the eighteenth century, the Spanish, French and English were as firmly established as the Portuguese along the Guinea coast. The Portuguese had extended their holdings in Mozambique; the Dutch had established themselves in the Colony of the Cape of Good Hope (often called the Cape Colony), in the south of the continent.

HISTORY OF THE AFRICAN CONTINENT IN THE NINETEENTH CENTURY

The history of the African continent in the nineteenth century, up to the seventies, was one of rather moderate change. In 1806 the British occupied the Dutch-held Cape Colony and in 1814 they annexed it. The Boers (Dutch farmers) of the district were not content with British rule; they withdrew from the colony and set up the independent republics of the Transvaal and the Orange Free State.

The French made themselves masters of Algeria. They began the conquest of that territory in 1830, in order to avenge an insult to a French consul. The city of Algiers was captured in July, 1830, and from that time

Photo © by Martin Johnson, from Camera Trails in Africa, © 1924, The Century Company

At an African camel-trading mart. Some camel-traders do business on a large scale, trading a thousand head at a time for a thousand others, as like those they bought as two peas—at least to the eyes of the uninformed.

the French gradually extended their possessions in the area.

An independent Negro state was created in Africa in the forties. The American Colonization Society, founded in 1817 for the purpose of settling free American Negroes in Africa, had bought some territory on the Gulf of Guinea. Here a colony of American Negroes was set up. In 1824 the colony received the name of Liberia or Land of Free Men (*liber* means free in Latin). Liberia became a republic in 1847.

In the seventies, there was a great revival of interest in Africa among the nations of Europe. For one thing, the great explorations of the nineteenth century (see Explorers of Africa, page 5199) had revealed Africa's resources—the boundless wealth of her forests and fertile plains, her undeveloped mineral resources, the unlimited water power offered by her cataracts.

There were political reasons, too, for the renewed interest in Africa. Germany had become a great European power following her defeat of France in the Franco-Prussian war; she was determined to build up a really great colonial empire. The Italians had won political unity at this time; like the Germans, they had colonial ambitions. The French were eager to make up for their loss of prestige in Europe by adding to their African possessions.

There now followed a mad scramble for African territory. It was set off by King Leopold II of Belgium, who proposed to establish a great state in the Congo Basin. This state was to be organized under the direction of the International African Association, which Leopold had helped to found in 1876. The region was opened up to commerce in 1879; soon representatives of the association were actively developing the resources of the country.

The great powers of Europe now followed Leopold's lead. The British took possession of certain territories on the Guinea Coast where their traders had long been active; they set up a protectorate over Bechuanaland, in southern Africa. The Germans laid claim to great areas on the east and west coast of the continent.

The French added to their existing possessions in West Africa by taking over much of the hinterland—that is, the country lying beyond or behind the coastal areas (*hinterland* is derived from two German words meaning behind-land). In 1881, the French moved into Tunisia, proposing to set in order the finances and administration of that district. Italy won a foothold on the east coast in what is now Eritrea.

It seemed certain that the countries taking part in the carving up of Africa would come into conflict. To prevent this, an international conference was held in Berlin in 1884 to work out an agreement between the various countries involved. In the following year, the General Act of the Berlin Conference was signed by the representatives of fifteen countries, including Great Britain, Germany, Austria-Hungary, Belgium, France, Italy and Portugal. It was provided that each power signing the act must notify the other powers before laying claim to new African territory; furthermore, a country must actually occupy the land that it claimed.

The Berlin Conference, in other words, set up definite rules for starting new African colonies. It also officially recognized King Leopold's enterprise in the Congo Basin. That area was to be an independent state—the Congo Free State—under the leadership of Leopold.

The colonization of Africa now went forward on a grand scale. In the year 1875, only about a tenth of Africa's soil was in the hands of the European powers. By the end of the century, they occupied by far the greater part of the continent.

CHANGES IN THE MAP OF AFRICA IN THE TWENTIETH CENTURY

There have been many significant changes in the map of Africa since 1900. France, Spain, Portugal and Great Britain have added to their possessions. Germany and Italy have lost all of theirs—Germany in World War I, Italy in World War II. Egypt has become an independent state. Ethiopia lost her independence in 1936, when the Italians overran the country, but regained it in 1941, when the Italians were driven out again.

What, then, is the situation in Africa today? There are three independent countries, Egypt, Ethiopia and Liberia, which together have an area of 776,000 square miles—about a fifteenth of the total area of the continent. The rest of Africa is divided up among France, Great Britain, Egypt, Belgium, Portugal and Spain.

The largest of the independent countries of Africa is Egypt. This historic land, which has seen many native and foreign rulers come and go, has been independent since 1922, though certain privileges have been granted to Great Britain. Egypt is a constitutional monarchy with a Senate and a Chamber of Deputies.

The total area of Egypt proper is about 386,000 square miles. Most of this territory consists of desert country. The only settled and cultivated areas—the Nile Valley, the delta of the Nile and the numerous oases—cover only about 13,600 miles. The population of the country, according to a recent census, is 17,423,000. The principal cities are Cairo, the capital (population, 1,312,000), Alexandria (686,000); Port Said (125,000), Tanta (95,000), Mansûra (69,000) and Fayûm (64,000).

Nine-tenths of the inhabitants are Mohammedans. The most influential Christian sect is that of the Copts; they are descendants of the Egyptians who adopted Christianity in the fourth century A.D.

The chief industry of Egypt is agriculture. The cultivated areas watered by the river Nile are almost unbelievably fertile; they produce fine crops of cotton, wheat, barley, beans, lentils, corn, millet, rice and sugarcane. The principal mineral products of Egypt are petroleum, phosphate rock and manganese ore. The domestic manufactures include cigarettes, refined sugar, petroleum products, rugs, leather, furniture, basket work and sponges.

Egypt shares with Great Britain the rule of the vast region known as the Anglo-Egyptian Sudan, south of Egypt, which is more than twice as large as Egypt herself. We describe this area on page 3057.

Ethiopia, a land of lofty mountains, deep valleys and broad plateaus, is a primitive land, where the love of freedom burns fiercely. It is, in name at least, a constitutional monarchy, though the people have little power. It has an area of 350,000 square miles and a population of 12,100,000. The only city of considerable size is the capital, Addis Ababa, with a population of about 150,000. Other towns include Dire Dawa (population, 30,000), Harar (25,000) and Gondar (22,000).

THE RACIAL ORIGINS OF THE PEOPLE OF PICTURESQUE ETHIOPIA

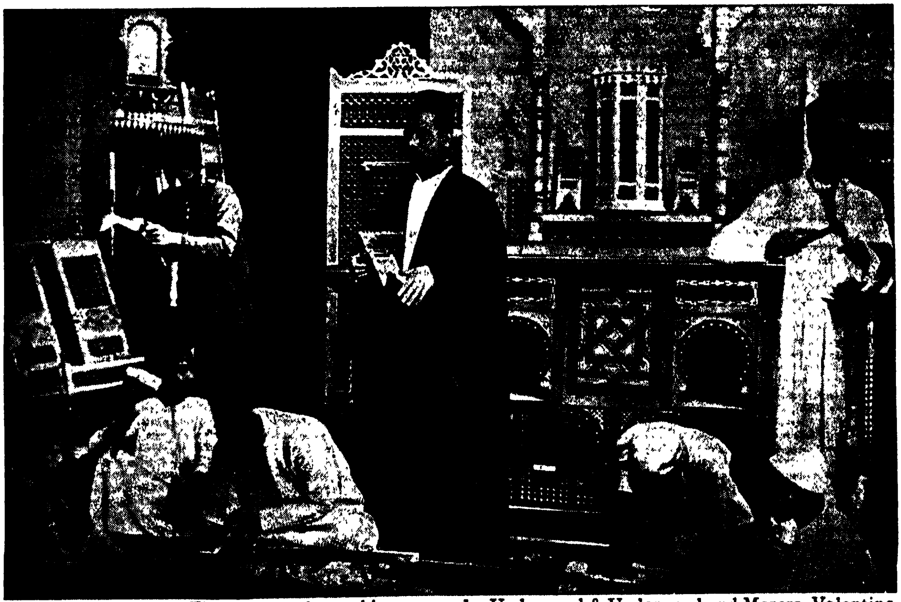
The people of Ethiopia represent a mixture of various races. The original inhabitants are said to have been of pure Caucasian (white) descent; they belonged to the Hamitic race. There has been much inter-marriage with the Negroes who live to the south and also with the Semitic races—particularly the Arabs from across the Red Sea. Many Ethiopians belong to the Coptic Church, a Christian sect that goes back to the early days of the religion. There are considerable numbers of Mohammedans, particularly in the north-western part of the country. The people known as the Falashas are of the Jewish faith.

Most Ethiopians are engaged in raising livestock and in farming. There is fine pasture country along the mountain slopes; here cattle, sheep and goats are numerous. The plateau lands are very fertile and produce fine crops of grain, wheat and tobacco. In

DAILY LIFE OF THE PEOPLE OF CAIRO

Cairo has a large European population. Its picturesque part is the native quarter. This is truly Oriental, and the latticework of the houses shows Saracen art at its best. The streets are thronged, and fruit-dealers do a good business.

The streets of Cairo are narrow and winding, and the buildings present a never ending variety of style. A traveler in the native quarter might think himself in some fairyland of The Arabian Nights. The lemonade-seller is a familiar sight.



The photographs on this page are by Underwood & Underwood and Messrs. Valentine

An old Arab writer said that "he who hath not seen Cairo hath not seen the world; its soil is gold; its Nile is a wonder; its houses are palaces; and its air is soft, its odor surpassing that of aloes-wood, and cheering the heart." Perhaps none of its people has done so much to beautify the native city as the craftsman who works in ivory and wood and produces the famous latticework. He uses his left foot as a third hand, and is known in the city as the "three-handed man."

the valleys we find sugar-cane, cotton and rubber-producing trees. Coffee is extensively cultivated. Ethiopia has great mineral wealth, though little has been done to develop it. There are deposits of iron, gold, coal, mercury, marble, copper, sulfate and potash.

Ethiopia is a land of great promise, but much must be done before her resources can be fully developed. Agricultural and mining methods are quite primitive. The transportation system is poor. There are less than 500 miles of railway and about 5,000 miles of good roads, most of which were developed by the Italians after their conquest of the country. Lack of roads has hindered Ethiopia's development, since it is so difficult to get its agricultural and mineral products to the world's markets.

The small Negro republic of Liberia, across on the west coast, has managed to survive as an independent state chiefly because of the protection of the United States. At present the finances of the country are under the supervision of American experts. Liberia has an area of 43,000 square miles. The population, estimated at 1,500,000, is almost exclusively Negro. The only important town is Monrovia, the capital (population, 10,000).

Five-sixths of Liberia is covered with dense tropical forests. Certain forest products are exported; these include rubber, palm

Network of roads constructed between Asmara, Eritrea, and Gondar, Ethiopia, by the Italians during their occupation of Ethiopia.

Pictures courtesy Hamilton M. Wright

A scene in Addis Ababa, the capital of Ethiopia, showing new landscaping. Considerable progress has been made in beautifying the capital.

kernels, palm oil, piassava fibre and cocoa beans. The rubber-producing trees that grow wild have not contributed a great deal to the rubber markets of the world. In 1925 an American company bought 1,000,000 acres of land in Liberia and started a rubber plantation there. At present this plantation is producing about 5,000 tons of rubber a year.

The natives cultivate rice, sugar-cane and cassava for domestic uses. Mineral production is not great; only gold and copper are produced in considerable quantities at the present time. Liberia, however, has great mineral wealth, much of which has not even been surveyed as yet. There are deposits of tin, zinc, iron, lead, bitumen and diamonds. The native tribes of the interior engage in various handicrafts. They weave native cloth and make mats out of palm fibre.

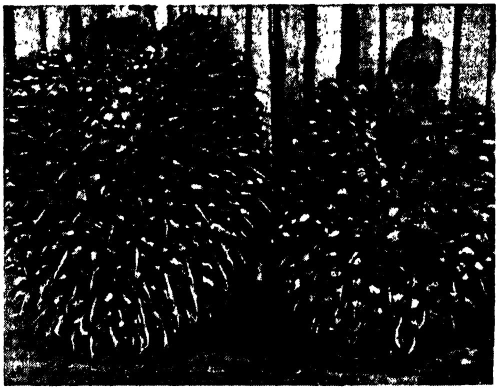
African territories in the French Union have an area of about four and a quarter million square miles—more than a third of the total area of the continent.

One of the most prosperous of France's colonies in normal times is Algeria. It extends for some 650 miles along the Mediterranean and has an area of 847,000 square miles. The population of the colony is 7,235,000. There are about a million Europeans, most of whom are Frenchmen. The natives are Arabs and Berbers, who belong to the Mohammedan faith. The chief cities are the capital, Algiers (population, 252,000), Oran (195,000), Constantine (107,000) and Bone (83,000).

THE MANY AND VARIED PRODUCTS OF FERTILE ALGERIA

Four-fifths of Algeria consists of Sahara Desert land; the most fertile areas lie along the coast. The chief crops are wheat, barley, oats, corn, potatoes, cotton, flax, grapes, vegetables and tobacco. The plateau lands that lie between the two parallel ranges of the Atlas Mountains are well adapted for grazing purposes. Here one finds great herds of cattle, sheep, camels, horses and asses. Iron ore and phosphate rock are mined in large quantities. Algeria's fisheries are very important; great quantities of sardines, anchovies, tunny and shellfish make their way to the markets of the world.

Little Tunisia, with a total area of 48,000 square miles, lies to the east of Algeria. It is called a protectorate, but it is really a French colony, for the native ruler, the Bey, has little real power. The population (2,608,000) is made up chiefly of Arabs and Beduins; Europeans number only 213,000. The only large city is Tunis, with a population of 220,000. Other cities include Sfax (population, 43,000), Bizerte or Bizerta (28,000), Sousse (28,000), Kairouan (23,000) and Gabes (19,000).


Courtesy, Free French Press Service

The palm tree called "elaeis guineensis" yields these ripe fruits, from which palm oil is obtained.

Over two-thirds of Tunisia consists of productive land. The chief crops include oranges, lemons, wheat, barley, grapes, olives and dates. Phosphate rock is mined in considerable quantities. Native industries include carpet weaving and the spinning and weaving of wool for garments.

France holds a protectorate over most of Morocco (154,000 miles out of a total of 167,000); this area is called the French Zone. (The rest of Morocco is made up of a Spanish Zone and a Tangier Zone.) The Sultan of Morocco, who is supposed to be an absolute monarch, does not have much power. To be sure, he issues from time to time imperial edicts which have the force of law; however, these edicts must be approved by a French official who is called the Resident General.

The total population of the French Zone is 7,991,000; about 250,000 are Europeans. The largest city of the zone is Casablanca, with a population of 453,000. Marrakesh (population, 200,000), Fez (144,000), Rabat (172,000) and Meknes (110,000) are also important; the sultan resides in each of these cities from time to time.

Agriculture is by far the most important industry in the French Zone; the chief crops are barley, wheat and corn. The cork industry is a flourishing one. The principal mineral, phosphate rock, is mined in great quantities under a state monopoly; iron ore, zinc, lead ore and manganese are also mined. The coasts abound in fish; Casablanca is an important fishing center. Under French rule a number of modern industries have been started. These include flour mills, breweries, soap and candle factories and cement factories.

South of Algeria we find France's largest African colony, French West Africa, with a total area of 1,816,000 square miles and a population of almost 16,000,000. It is divided into eight territories—Senegal, French Guinea, the Ivory Coast, Dahomey, French Sudan, Mauritania, Niger and the district known as Dakar and its dependencies. Dakar, the capital of French West Africa, has a population of 113,000. Other towns include Kaolak (population, 29,000) and St. Louis (46,000), in Senegal; Porto Novo (27,000), in Dahomey; and Abidjan (26,000), in the Ivory Coast.

French West Africa is a land of endless variety. Niger and Mauritania, in the north, are given up for the most part to the endless sands of the Sahara. In the areas facing the Gulf of Guinea, there are dense tropical forests; the French Sudan has vast grassy plains. There are comparatively few Europeans in French West Africa; these are scattered all over its immense territories. In the northern districts of Mauritania and Niger, the population is made up chiefly of Berbers. Elsewhere the natives are Negroes.

Agriculture is important in French West Africa; the crops include groundnuts, groundnut oil, cotton, bananas, pineapples, tobacco, rice, coffee and millet. The forests of the Ivory Coast and Dahomey, on the Gulf of Guinea, yield mahogany, palm oil, rubber and gum arabic; its palm trees yield valuable oil. In the French Sudan, there are large herds of cattle, sheep, goats, camels and asses. Much salt is produced in Mauritania.

Deep in the heart of Africa lies another great French colony, French Equatorial Africa (also called the French Congo). It extends to the north as far as Libya, while on the southwest its shores are bathed by the waters of the South Atlantic. French Equatorial Africa is divided into four areas—Gabun, Middle Congo, Ubangi-Shari and Chad. The total area of the colony is 959,000 square miles; its population is 3,531,000. Negro natives make up almost all the population; there are very few Europeans. The capital is Brazzaville.

Courtesy, Free French Press Service

Native troops and their families stage a picturesque dance, called the "tomtom," in French Equatorial Africa.

Courtesy, Free French Press Service

In French Equatorial Africa logs are often transported to water's edge by way of the narrow gauge railway.

The tropical forests which extend inland from the South Atlantic contain many valuable species of trees; of these, the rubber-producing trees are the most important. Great herds of elephants range through the forests; the ivory of their tusks is a valuable article of export. In the Chad district, there are great numbers of cattle, sheep, camels, horses and ostriches. The natives cultivate coffee and cotton.

The French hold the island of Madagascar, off the east coast of Africa; this is one of the largest islands in the world, with an area of 241,000 square miles. The population is 3,798,000. The natives belong to the Malagasy race, a branch of the great Malay family. The French on the island number only about 25,000. There are also a number of Hindus, Chinese and Arabs, who carry on retail trade. The capital, Tananarive, in the center of the island, is quite a flourishing city, with a population of 127,000. Tamatave (population, 21,000), on the east coast, and Diégo-Suarez (12,000), on the north coast, are important ports.

Cattle breeding and agriculture are the chief occupations of the natives. The principal crops are rice, sugar-cane, coffee, manioc, corn, vanilla and tobacco. The dense forests of the island abound in valuable woods; rubber, gum and resins are important forest products. Medicinal plants are plentiful. The most valuable minerals are graphite, mica and phosphates.

French Somaliland, with an area of only 9,000 square miles and a population of 44,000, lies at the southern end of the Red Sea. The capital, Djibouti or Jibuti (population, 10,000), is connected by railway with Addis Ababa, the capital of Ethiopia. Much of Ethiopia's commerce passes through Djibouti.

The French flag also flies over the Comoro Islands, northwest of Madagascar, and over the island of Réunion or Bourbon, some 420 miles east of Madagascar. Réunion (area, 970 square miles) is quite unusual as colonial possessions go, for more than 214,000 of its 221,000 inhabitants are French.

After World War I, France and Great Britain divided up the former German colonies of the Cameroons and Togoland, on the Gulf of Guinea; these territories were assigned to them under a mandate of the League of Nations. The area of the French Cameroons (or Cameroun) was 166,000 square miles and the population 2,500,000. French Togoland was a small area of about 22,000 square miles to the west of Dahomey with a total population of 780,000. Both the Cameroons and Togoland are now governed as United Nations trusteeships.

© Ewing Galloway

Shipping cocoa from the Gold Coast. The cocoa is loaded on boats and these are rowed out to waiting steamers.

The Vichy Government that was set up in France after her surrender in World War II (June, 1940) claimed full power over all French colonies, including those in Africa. In November, 1942, the Vichy Government lost its weak control over these colonies.

Some of them (French Equatorial Africa, French Cameroun, French Somaliland, Madagascar, Réunion) had already joined the Fighting French, a group of Frenchmen who never gave up the fight against the Axis. Algeria, French Morocco and French West Africa accepted the authority of the High Commissioner for French North Africa, an official working with the Allies. Unhappy Tunisia became a battle zone, where the Allies locked in a life-and-death struggle with the Axis.

The British possessions in Africa are second only to those of France in area. We tell you about Great Britain's African empire in another chapter of The Book of Knowledge (see page 3047).

Before she entered World War II (in June, 1940), Italy had a great African empire, covering an area of almost 1,240,000 square miles. It consisted of two great colonies—Libya and Italian East Africa. These territories have now been lost to Italy as a result of the war. Ethiopia, which had formed part of Italian East Africa, regained her independence. The rest of Italy's former African possessions were occupied by British Empire troops, drawn from all parts of the Empire.

The largest and, in normal times, the most prosperous of these areas is Libya, which lies on the Mediterranean. The area of Libya has been estimated at 679,000 square miles and its population at 888,000. The natives, who number almost 800,000, are chiefly Mohammedans of Arab and Berber stock. Tripoli (population, 108,000) and Benghazi (65,000) are the seats of government. Other cities include Misurata (45,000), Homs (35,000) and Derne (22,000).

Much of Libya, particularly the regions to the south, is covered by the sands of the desert. Many parts of the coastal areas, however, are very fertile. Here olives, almonds, oranges, dates, figs and grapes are grown in great quantities. Among the other products of the colony are tobacco, carpets, leather articles and fabrics embroidered with gold and silver. Libya's fisheries are famous.

Eritrea and Italian Somaliland, on the eastern coast of Africa, were formerly combined with Ethiopia to form the colony of Italian East Africa. Eritrea, on the Red Sea, is a small territory with an area of 16,000 square miles and a population of 610,000. The capital is Asmara, which has some 85,000 inhabitants.

Crops have been successfully grown in Eritrea, particularly where irrigation has been introduced. Stock-raising is fairly important. Pearl-fishing is carried on at Massawah, on the coast. There are immense salt works at Massawah and at other places on the arid coast of this little province.

Former Italian Somaliland, which has an area of 194,000 square miles and a population of over a million, extends along the Indian Ocean for some 1,100 miles. The largest city is the capital, Mogadiscio, with a population of 55,000. The country provides a good deal of the world's incense. Other products are oil, gum, hides, butter, cotton, resin, kapok and bananas.

The Belgian Congo, formerly the Congo Free State, was annexed by Belgium in 1908. This colony, with an area of 902,000 square miles, is about seventy-five times as large as Belgium, the mother-country. The Belgian Congo has a short coastline on the South Atlantic, at the mouth of the Congo River, but for the most part it is shut in by surrounding territories. Much of it is covered by great tropical forests. The population is about 10,000,000; there are only about 28,000 whites in all. The capital is Léopoldville, on the Congo.

The mining industry flourishes in the colony; the Belgian Congo has become the world's leading producer of diamonds. Other minerals include copper, gold, silver, cobalt, radium and iron. The colony also produces considerable quantities of palm oil, palm nuts, cotton, coffee, sugar, corn, rice and fiber for the markets of the world.

Following World War I, the districts of Ruanda and Urundi, which formerly belonged to Germany, were given to Belgium under a mandate of the League of Nations. These two territories, which lie to the east of the Belgian Congo, have a total area of 20,000 square miles and a population of 3,767,000. Ruanda-Urundi is now a United Nations trusteeship.

When Belgium fell into the hands of the Germans, in 1940, the Belgian colonies came under a Belgian government-in-exile, with headquarters in London. The Belgian Congo continued contributing to the Allied cause by producing such war materials as copper, diamonds (used in industry), iron and fiber.

The Portuguese, who were the first Europeans to establish settlements in Africa, have a fairly extensive African empire. Their largest colony is Mozambique (also called Portuguese East Africa), which lies on the eastern coast. The colony has an area of 298,000 square miles and a population of 5,085,000. The capital, Lourenço Marques (population, 47,000), is an important seaport; other ports include Beira, Mozambique and Quelimane. The chief products of the colony are corn, cotton, copra, sisal, beeswax and mining products.

Angola, or Portuguese West Africa, lies on the west coast. Its area is 481,000 square

Courtesy, Belgian Information Centre

View of Léopoldville, capital of the Belgian Congo since 1923. Léopoldville, which was founded by Henry Morton Stanley in 1882, is on the left bank of the mighty Congo River near the Stanley Pool; it is some 235 miles northeast of the mouth of the Congo. It is connected by rail with Cape Town and Portuguese East and West Africa.

miles; its inhabitants number 3,738,000. The most important towns are the capital, São Paulo de Loanda, Benguela, Mossâmedes and Cabinda. Many areas of the interior are very fertile and yield good crops of coffee, corn, sugar, wheat and tobacco. Wax, rubber, palm oil and palm kernels are also important products. Diamonds are mined in considerable quantities; other minerals include iron, petroleum and salt.

THE TWO SMALL ISLANDS OF SÃO TOMÉ AND PRINCIPE

Farther to the north, on the Gulf of Guinea, we find the two small islands of São Tomé and Principe, which form a Portuguese province under a governor. The combined area of the two islands is about 372 square miles; the population is 60,000. Cinchona, a plant from which quinine is obtained, is one of the chief products of the islands.

Portuguese Guinea, on the North Atlantic coast, is entirely shut in on the land side by French West Africa. It has an area of 14,000 square miles and a population of 351,000. Its principal products are rice, wax, oil, seeds and hides. The capital and chief port is Bissau.

To the northwest lie the Cape Verde Islands, some 300 miles from the African mainland. There are fifteen islands in all, with an area of 1,600 square miles and a population of 181,000. Sugar, coffee, beans, corn and tobacco are produced here. The chief town and capital is Praia, on the island of Sant'Iago.

The Madeira Islands, off the Moroccan coast, have an area of 300 square miles and a population of 53,000. They are famous for their wine; other products include sugarcane, fruit and vegetables. The capital, Funchal (population, 48,000), has a splendid harbor.

The foreign possessions of Spain, which was once the world's greatest colonial power, are now limited to her African territories. Her largest colony is Rio de Oro, on the North Atlantic. Rio de Oro, with an area of 73,000 square miles, looks far more imposing on the map than it really is. It is a poor and unproductive land; there is but little agriculture and the native inhabitants gain a scanty livelihood by fishing. The capital is Villa Cisneros. Rio de Oro has a white population of less than a thousand. No census has ever been taken of the natives.

Spain holds a protectorate over a small part of Morocco (18,000 square miles)—the area known as the Spanish Zone. The population is 992,000; the principal towns are Tetuán (population, 50,000), Alcázar (31,000) and Larache (29,000). The Spanish Zone is said to be rich in minerals; its soil would produce fertile crops if irrigation were introduced. The Spaniards have done little, however, to develop the area.

The Tangier Zone of Morocco (area, 225 square miles), on the Strait of Gibraltar, is a neutral district, governed by an international body. Spain held this zone for a time. She also holds another Moroccan district, Ifni (area, 741 square miles), which lies on the North Atlantic; it is shut in on the land side by French Morocco.

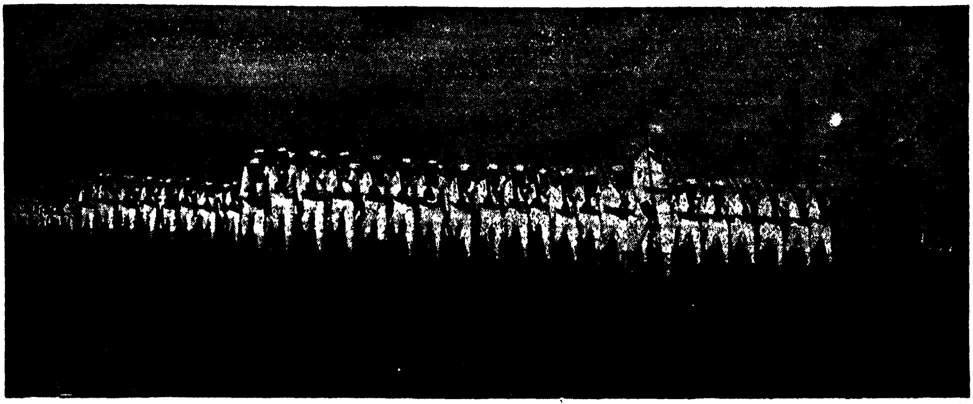
The Spanish flag flies over an area of 11,000 square miles on the Gulf of Guinea; this area consists of about 10,000 square miles of mainland and a number of islands. A decree of 1935 divided these possessions into two districts—Fernando Pó and Continental Guinea. The first of these areas takes in the fertile island of Fernando Pó; the second includes the mainland area and a number of islands. The Spanish Guinea areas have valuable timber lands but are quite undeveloped. The seat of government, Santa Isabel, on the island of Fernando Pó, is a small town of 15,000 inhabitants.

THE CANARY ISLANDS ARE DIVIDED INTO TWO PROVINCES

The Canary Islands, off the northwestern coast of Africa, have been divided into two provinces, and these are on the same footing as any of the fifty provinces into which Spain is divided. The area of the islands is 2,800 square miles and their population is 565,000. The climate is mild and the soil is very fertile. Great quantities of fruits and vegetables are grown; exports include wine, tobacco and bananas. The chief cities are Las Palmas (population, 136,000) and Santa Cruz (92,000), which are the capitals of the two provinces into which the islands are divided.

We can not tell what the future has in store for the African continent. Will there be, as at present, a system of great colonies, developed mainly in the interest of the motherlands? Will the resources of the continent be made equally available to all nations? Will the three independent countries of Africa continue to maintain their freedom? Will other independent countries be set up? The answers to these questions depend to a large extent on how effective the United Nations becomes in settling international conflicts by peaceful means.

THE NEXT STORY OF ALL COUNTRIES IS ON PAGE 6857.



U. S. Navy Official Photograph

Sailors are given land drill, in order to prepare for landing expeditions.

SHIPS AND SAILORS OF OUR NAVY

IN another part of our book we have told you some of the stories of the United States Navy while it was small and weak. There are many other stories of bravery and skill which we did not tell, but we cannot find space for them all. They would entirely fill our book. Now we shall talk about the Navy to-day, when it is one of the largest and strongest in the world.

The ships in which Perry, Decatur, Hull and the rest fought were sailing vessels built of wood. They carried a great many guns, more than the largest battleships do now, but these guns were small, did not carry far, and were not very accurate. One of the smaller battleships of to-day could destroy any number of the best wooden ships of the War of 1812. They could hardly get near enough to fire a shot, and if by chance they did, they could not do much harm.

You have read of the battle between the Merrimac and the Monitor in the Book of the United States. This was the first battle between two iron ships in the world. Small iron-clads like these started the building of all the mighty battleships which cost so much money and can do so much harm.

Though the United States had a large fleet during the Civil War, after the war was ended the people wanted peace so much that the Navy was neglected. It was thought that no foreign power would interfere with the United States, and the old wooden ships were allowed to rot. For a time the United States did not have a single armored ship.

Men began to see that the United States would be helpless if attacked, and in 1883 Congress ordered four armored ships to be built. Four more were ordered in 1885, and each year after this several more were ordered. In 1890 Congress ordered three large battleships. Others were built later, and the work of the Navy in the Spanish-American War convinced the country that we must have many more ships.

There are many kinds of ships in a first-class navy, used for different purposes. We often speak of the great gray battleships as if they were all. These battleships are very important, and they cost a great deal of money, but in any navy they are few, compared with the whole number. Besides the battleships there are usually cruisers of several kinds, gunboats, destroyers, submarines and submarine-chasers, flying boats, aircraft carriers, oilers, supply ships, hospital ships, tugs and others.

Let us look at the United States Navy. First to be mentioned are the battleships. There were forty of these built or being built at the beginning of 1918, but in 1921, following a treaty between the United States, the British Empire, France, Japan and Italy, the number was reduced. More were built after 1938, but battleships as well as smaller ships have been sunk in World War II. The new battleships are several hundred feet long, and have very powerful engines which give all the newer ships a speed of twenty-five knots, or more. The ship is protected above the water-line by plates of hardened steel from twelve to eighteen inches thick. They have from eight to twelve big guns and a large number of smaller ones.

HOW THE BATTLESHIPS AND CRUISERS ARE NAMED

One of these great ships cost at least $15,000,000, and some of them cost much more. It costs thousands of dollars to fire its big guns. It carries a crew of over one thousand men. Ships differ so much that we cannot give exact figures. The battleships are named for states, as California, New York, Oklahoma and North Carolina.

Next come the cruisers. There are several kinds of them. Generally we can say that a cruiser is smaller, has lighter armor and fewer guns than a battleship, but greater speed. The idea is to have a ship which can get to the point of danger quickly and will still have power to damage the enemy. Some cruisers were formerly named for states. Now they are called for cities as Quincy, Wichita and Chicago.

One of the most important ships is called the destroyer, and got the name in a peculiar way. Years ago, when the torpedo first came into common use, small ships were built which fired torpedoes from the deck. Larger ships were built to fight them and were called torpedo-boat destroyers. They carried torpedo tubes and rapid-fire guns also. They were so much superior to the torpedo boats that few of the latter are built now, but every navy has many destroyers.

THE MANY SERVICES OF THE SWIFT LITTLE DESTROYERS

The destroyers have no armor, but do have great speed. Some of them can make over thirty knots. They are armed with three- or four-inch guns and carry torpedo tubes. They run errands, protect merchant vessels and look for mines and submarines. It is possible for their torpedoes to sink a battleship. Their guns will smash a submarine, and if it submerges, they will drop depth bombs into the water where it went down, or where they think it has gone. The depth bomb is a steel case containing explosives which can be set to explode at any depth desired. As you know, the pressure of water increases with depth, and since experiments have shown the difference the bomb is set to explode at a certain pressure. This bomb may destroy a submarine even if it explodes some distance from it. The United States destroyers are named for the naval heroes, as Farragut, Hull and MacDonough.

Next we come to the patrol boats that make up the "mosquito fleet," so called because these boats are small but have a dangerous sting! The boats called patrol torpedo craft carry torpedoes and depth charges and can sink big ships as well as submarines. The submarine-chasers do not carry torpedoes; they have depth charges and are armed with machine guns.

THE GREAT FLAT DECKS OF THE AIRCRAFT CARRIERS

The navy has a number of aircraft carriers, and is building more. These have great flat decks on which about one hundred planes can be carried. Some of the newer battleships also carry a few planes.

We have told of the submarines and of the flying boats in other stories in our book, and cannot tell more of them here.

A battleship uses a great deal of oil as fuel, but does not have much room to carry it. So we have oilers which carry many gallons and meet the battleships at some place agreed upon, or else stay with the fleet except when a fight is expected. Formerly ships burned coal as fuel, and were attended by colliers, which carried coal to the battleships, but now our battleships all burn oil. Those formerly burning coal have been changed to oil burners.

There is not much room for wounded on a warship of any sort, and they cannot be looked after very well. So hospital ships are fitted up to take care of the wounded from the fleet. Some of them have every convenience that a good hospital would have.

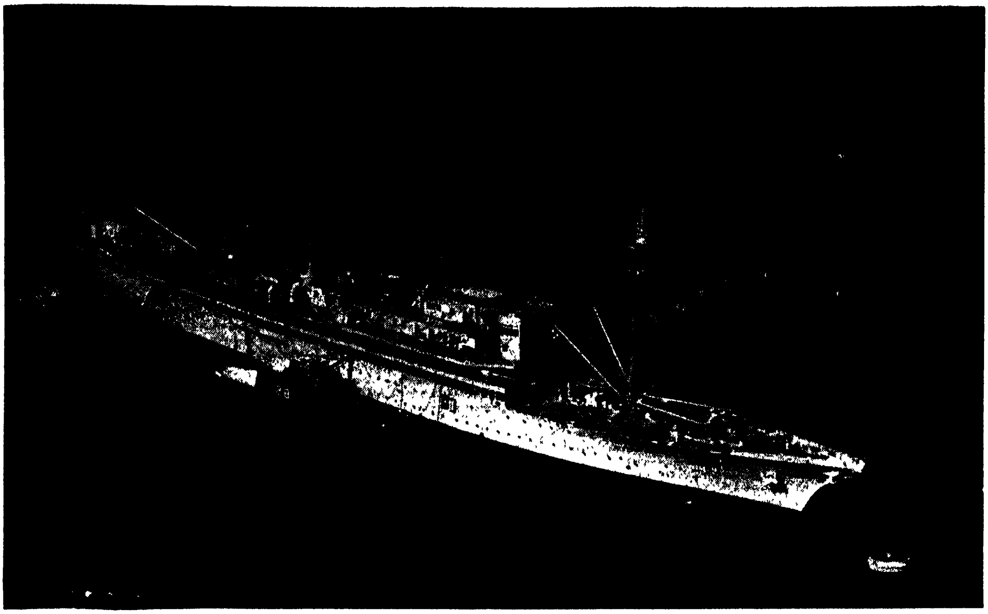
Besides these which we have mentioned, many vessels are needed in a well-equipped navy. It must have tugs and supply ships, and often a vessel is fitted up as a workshop, where repairs too difficult to be made on a fighting ship may be done. One or more of these will go with every fleet.

In the two World Wars the Navy gave a good account of itself, and earned its country's gratitude.

THE MEN WHO SERVE ON THE BATTLESHIPS

Now who are the people on the battleship? Let us first take the officers. In our story of Annapolis we told you that the young graduate becomes an ensign. This corresponds to second lieutenant in the army. Next in rank is lieutenant, junior grade, equal to first lieutenant in the army, while lieutenant corresponds to captain.

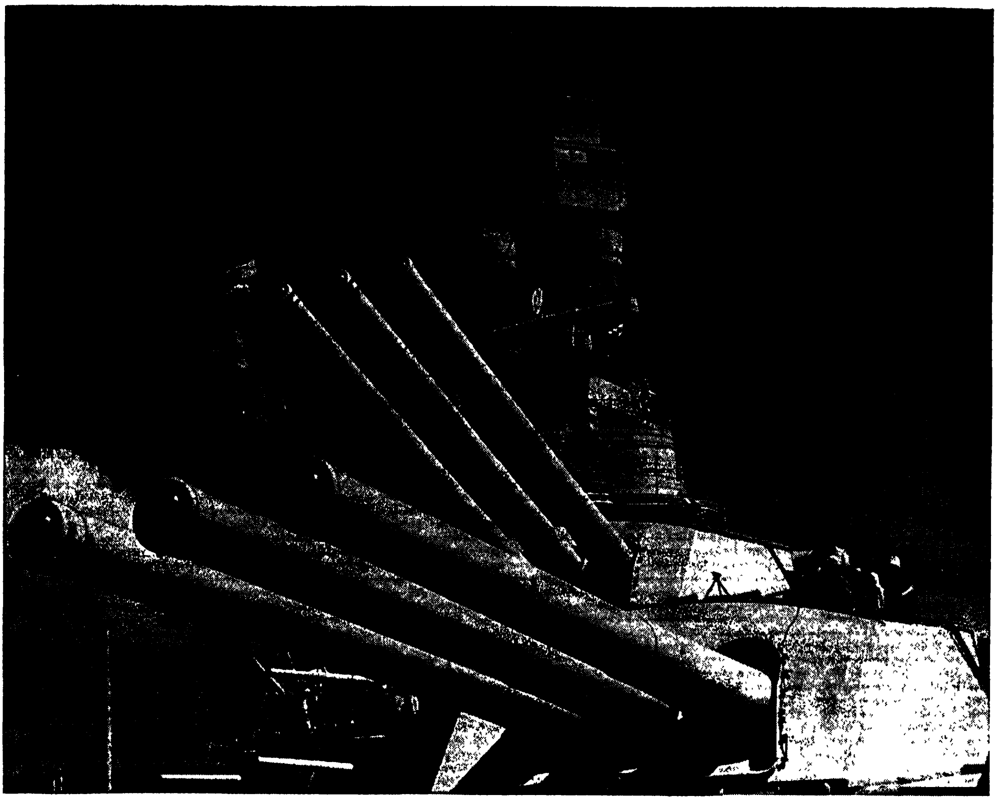
SUBMARINE TENDER AND DESTROYER



The U.S.S. Holland, a submarine tender or "mother ship," with submarines moored alongside. Some U-boats (undersea boats) can not carry much fuel; they would have to work only near a land base without a tender, which carries fuel, spare parts and a workshop. Some large U-boats, however, have a cruising range of thousands of miles. The U-boats are deadly. Their chief weapon is the torpedo; big submarines also have large deck guns.

U. S. Navy Photographs

A modern destroyer, the U.S.S. Mahan. Destroyers are small, usually of 1,200 to 1,500 tons, but they can develop thirty-six knots or more. Each is equipped with four to ten guns, of four-inch or five-inch caliber, a number of torpedo tubes and anti-aircraft guns. Destroyers often work in groups, called flotillas, under a flagship which is somewhat larger. They hunt submarines, and convoy merchant ships in dangerous waters in wartime.



U. S. Navy Official Photograph

Six 14-inch guns of the forward turrets on the U.S.S. Pennsylvania. This is a great battleship of 31,400 tons.

Next comes lieutenant-commander, corresponding to major, and commander, corresponding to lieutenant-colonel in the army. The captain in the navy is equivalent to the colonel in the army. Above the captain the ranks are rear-admiral, vice-admiral, and admiral. There are many warrant officers and petty officers which correspond in a general way to sergeants and corporals in the army, though their positions are more important in some ways and they get more pay.

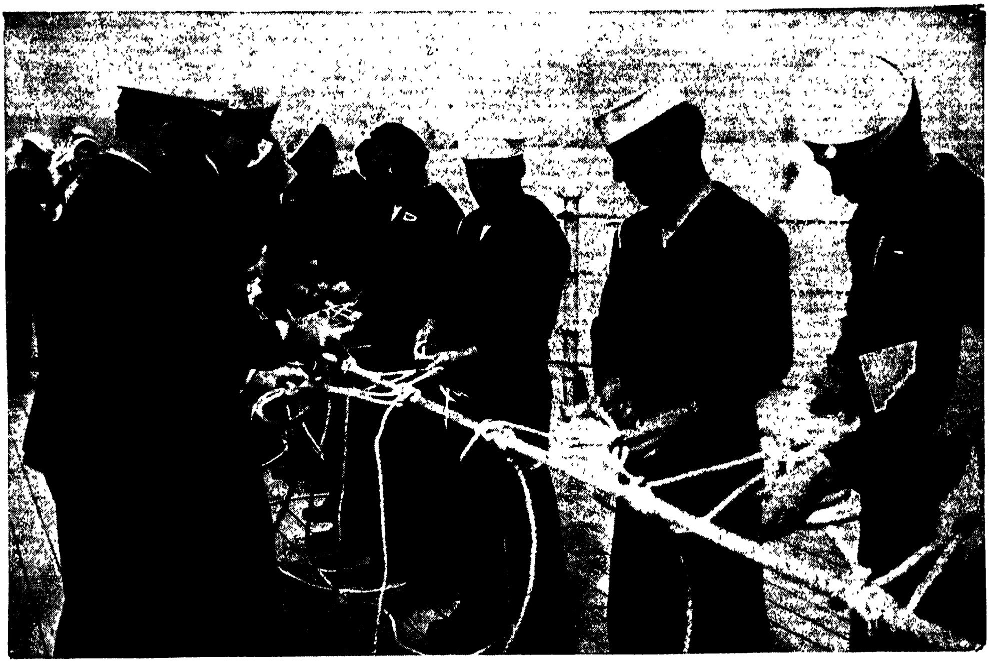
Ordinarily a man enlisting in the navy for the first time must be between seventeen and thirty-one years, and he must be able to read and write English. Special rules are made during wartimes. A man may become a seaman, or work at a trade. A battleship is a mass of complicated machinery, and carpenters, machinists, shipwrights, steamfitters and electricians are needed. Yeomen are the clerks. Hospital attendants, druggists and cooks are also needed.

When a young man enlists he is usually sent to a training station for a few weeks or months. Here he learns the drill, the great lessons of obedience, neatness and promptness, and begins to learn his duties. Life on a ship is strange in many ways. The sailors sleep in hammocks or bunks which are rolled up out of the way in daytime. The tables from which they eat are often swung up to the ceiling when not in use. Every inch of space is precious, and the same room must be used for several things. Each sailor has a box with a lock in which he may keep any small things he prizes. His clothes are kept in a strong bag, and every article must be folded and rolled in a particular way. An officer frequently inspects the bags.

In addition to the crew, every battleship usually carries a detachment of the United States Marine Corps, who are trained and equipped very much like regular soldiers, but may spend a considerable part of their service afloat. In case of trouble in a port the Marines can be quickly landed.

THE NEXT STORY OF FAMILIAR THINGS IS ON PAGE 6965.

ABOARD A MAN OF WAR

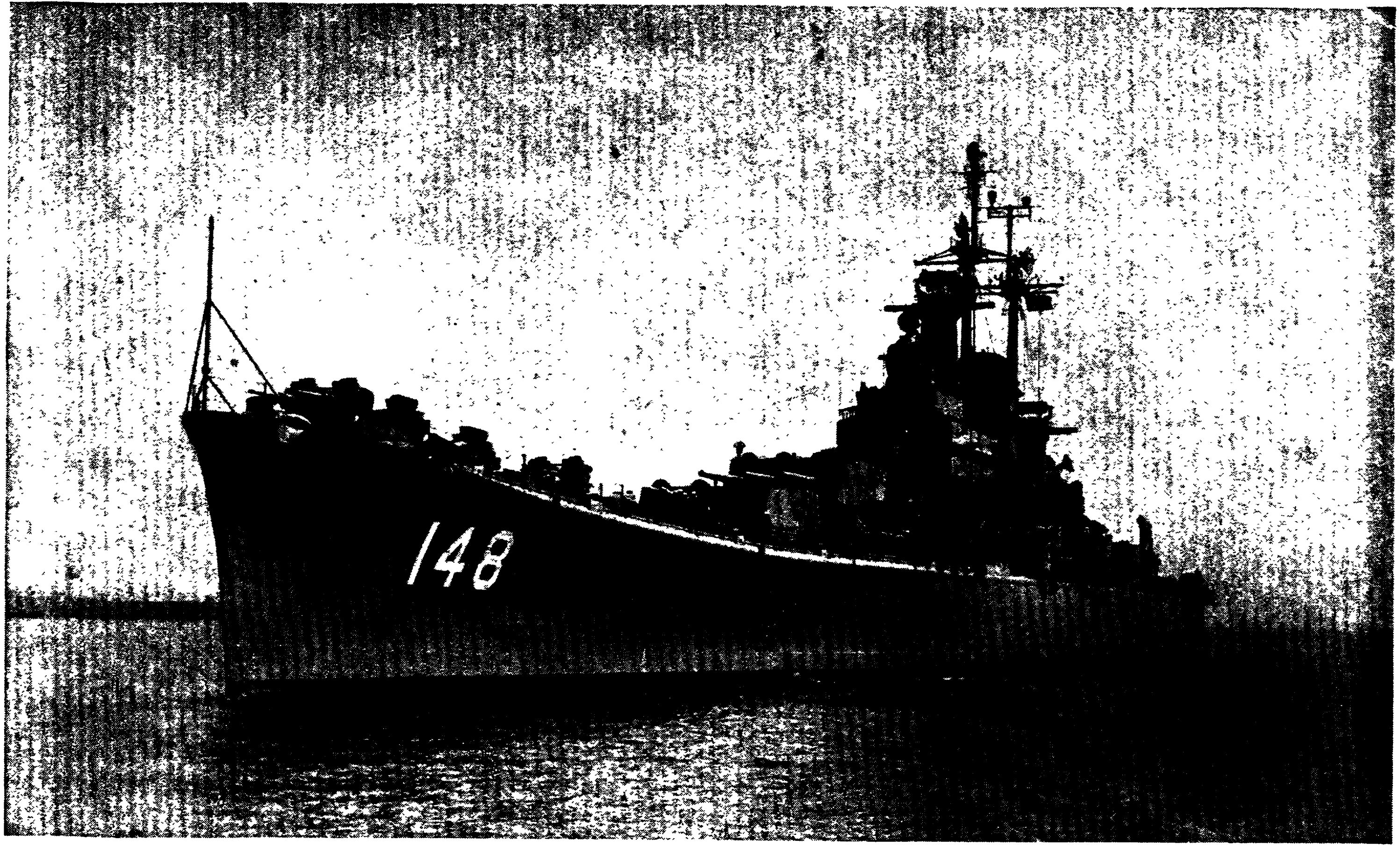


Every seaman must still learn how to tie seamanlike knots, just as in the days of the old sailing ships. You can learn to tie some of the sailors' hitches and splices, if you will practice following the directions on page 3253. Some knots have fascinating names, like bowline on a bight, and chain knot and toggle.

U. S. Navy Official Photographs

The food served on the ships is always good, but on holidays and special occasions extra attention is given to the bill of fare. Young men almost always improve their health while in the navy. Here you see the cooks carving the turkeys for a gala dinner. The ship's kitchen is called the galley.

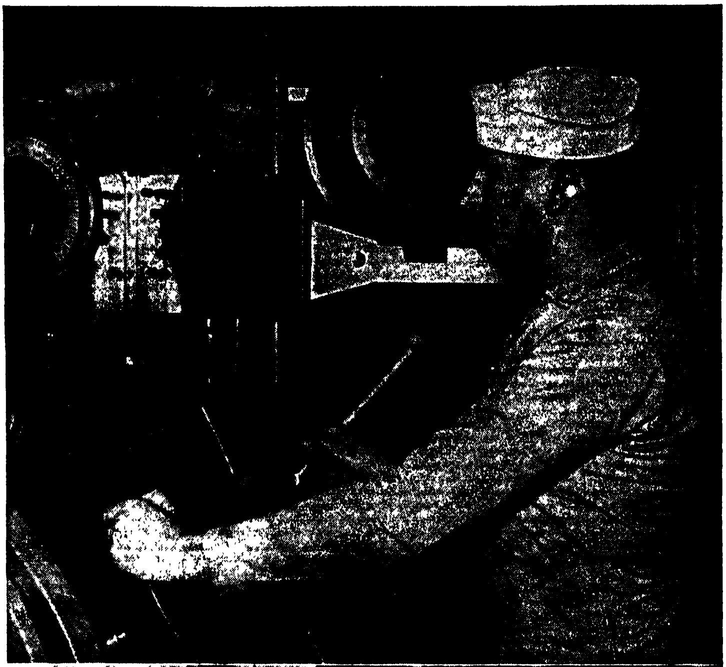
THE U.S.S. NEWPORT NEWS, OF THE CRUISER CLASS



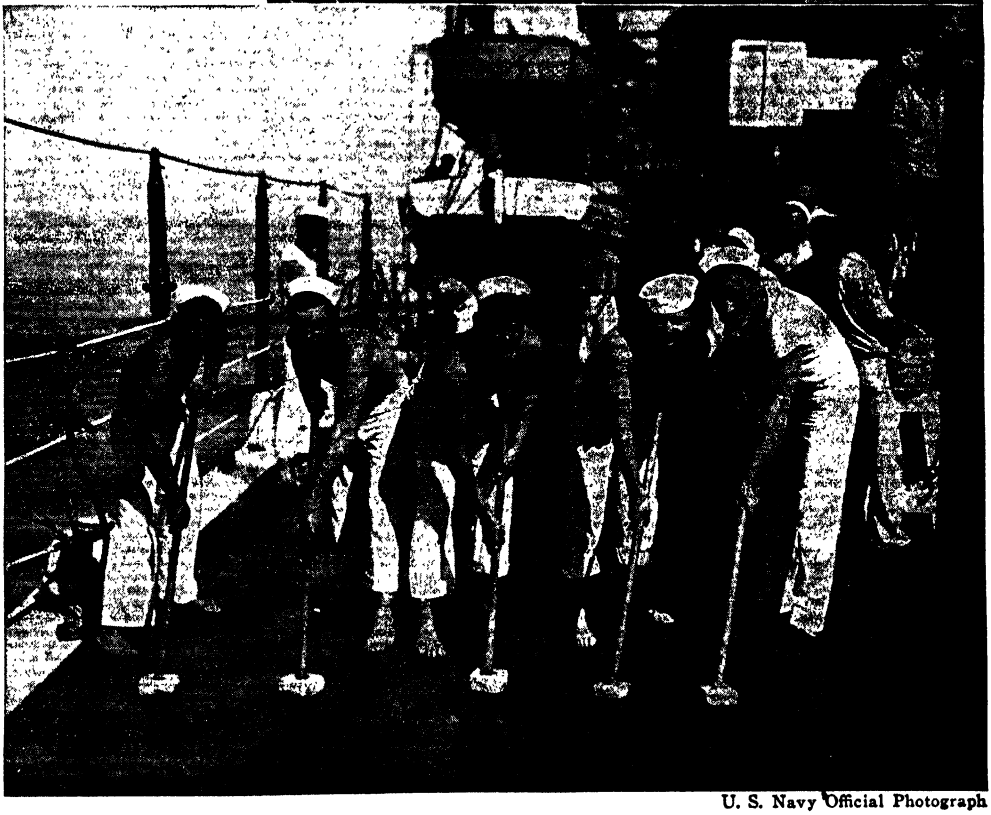
Official U. S. Navy photograph

A cruiser is smaller and usually faster than a battleship. From upcurving bow to superstructure aft, this ship has beautifully balanced lines.

SOME DUTIES OF A GOB



The gob, or bluejacket, or sailor, has many duties including service in the control room, and keeping the decks clean.



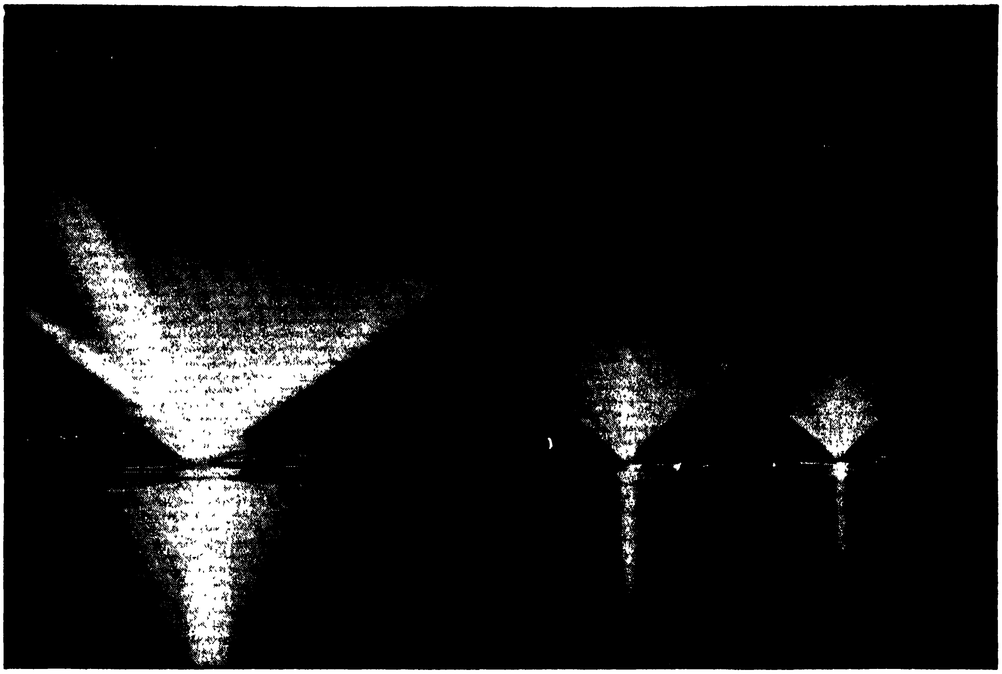
U. S. Navy Official Photograph

The decks, in addition to their daily scrubbing are scoured weekly with fire brick, familiarly known as "holystone."

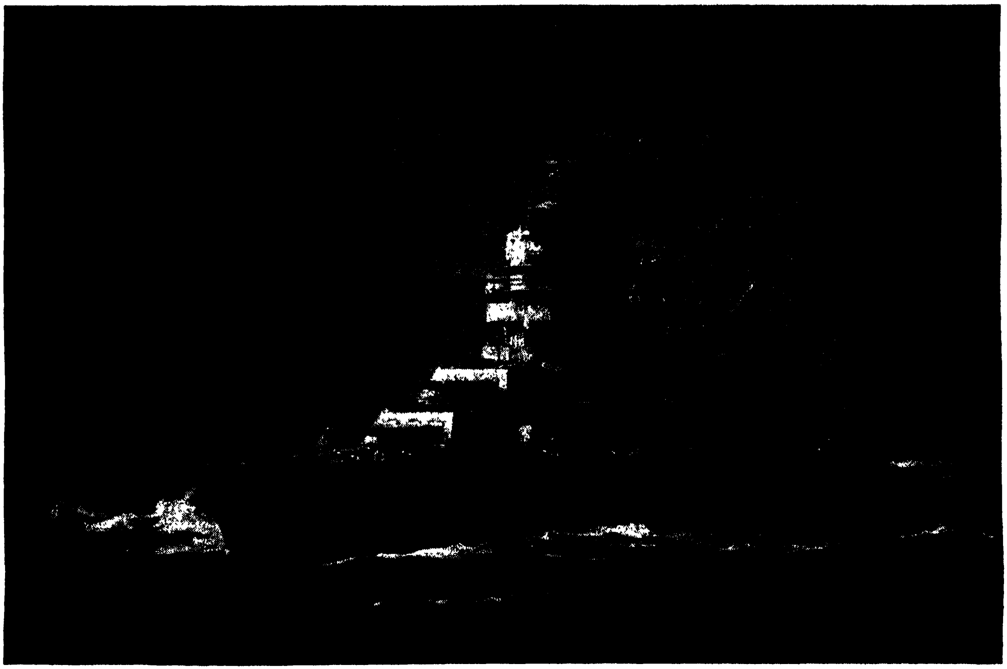
FLAT TOPS FOR THE NAVY'S WINGS

U. S. Navy official photographs

At top, a signal officer guides the pilot of a Grumman Avenger torpedo bomber into a safe landing on the flight deck of a carrier. Below, the huge Coral Sea (named for the famous World War II naval battle) cleaves the water. The planes take off toward the bow, into the wind as the ship is moving.



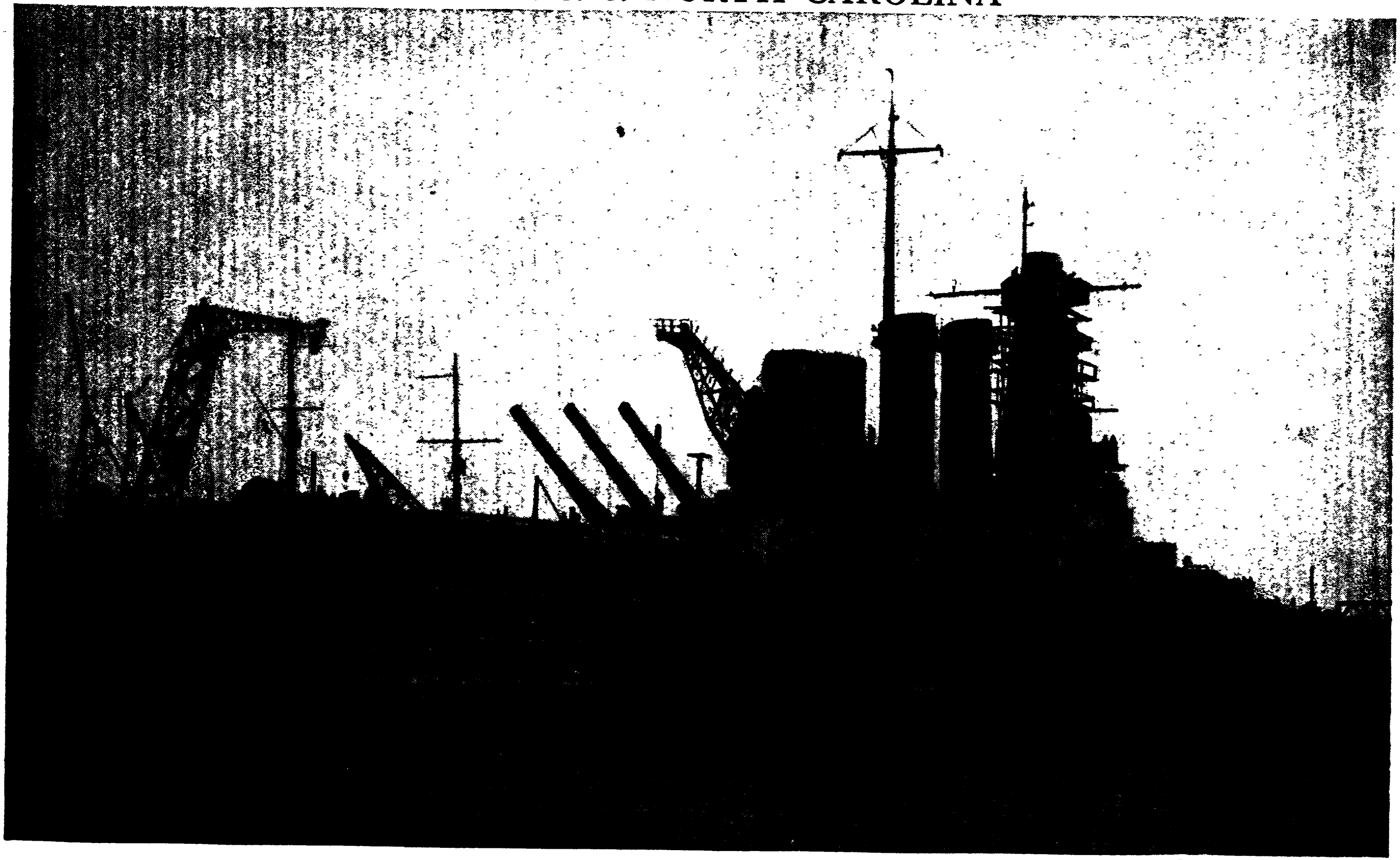
The modern battleship must be not only watchful by day, it must also be effective at night. In order to keep keen lookout for enemies it is fitted with powerful searchlights that can be flashed in all directions. The big ships are sometimes called capital ships, or ships of the line.



U. S. Navy Official Photographs

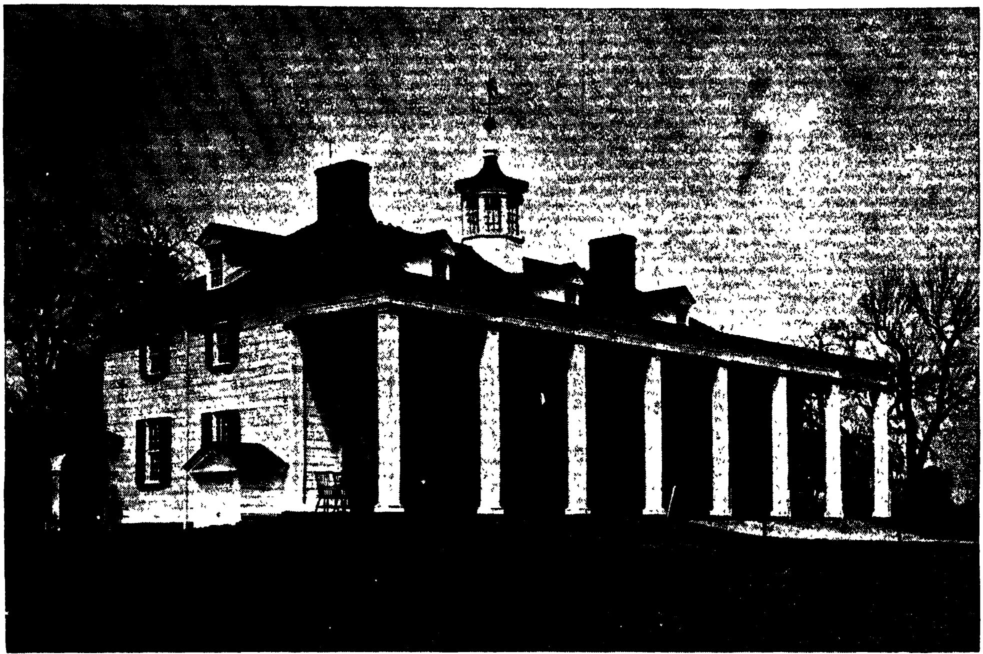
The U.S.S. Idaho is a modern battleship of 32,000 tons. A battleship is fully armored, with steel plates at least ten inches thick, and often much thicker. It is fitted with large and small guns, the big ones arranged in turrets that can be moved. The modern battleship also carries anti-aircraft guns.

THE U. S. S. NORTH CAROLINA



© Acme Newspictures, Inc.

The North Carolina, 35,000-ton battleship, commissioned in the United States Navy, April 8, 1941. She is one of the biggest battleships afloat, and carries nine sixteen-inch guns and a heavy battery of smaller guns, also anti-aircraft guns. The main guns can hit a target nineteen miles away



Courtesy, Virginia State Chamber of Commerce

Mount Vernon, where George Washington once lived, overlooks the Potomac River near Alexandria, Virginia.

SOME *of our* HISTORIC SHRINES

WHEN we visit some Old World cities we may see buildings one thousand—or even two thousand years old—and there are many places where important things happened much longer ago than that. In fact, some parts of the Old World have been inhabited so long that one can hardly travel ten miles without passing the scene of some important or interesting far-distant historical event.

No white settlement in the United States is four hundred years old. Much of our land has been inhabited by white people for little more than a century, and some of it is still sparsely settled. Yet, in our relatively short history, events have moved so swiftly and with such dramatic effect that we have already come to have an astounding number of places of historic interest. These are of many kinds: places founded by pioneer settlers, buildings where events important to our national life took place, homes of poets and statesmen and patriots, battlefields where men fought to protect their homes or for some political ideal that they believed to be right. Every state has some shrines.

On the following pages you will find pictures of some of these historic shrines, but there are dozens of others in the chapters on the growth of the United States, in those which describe the different regions of our land, and in the stories of famous men and women.

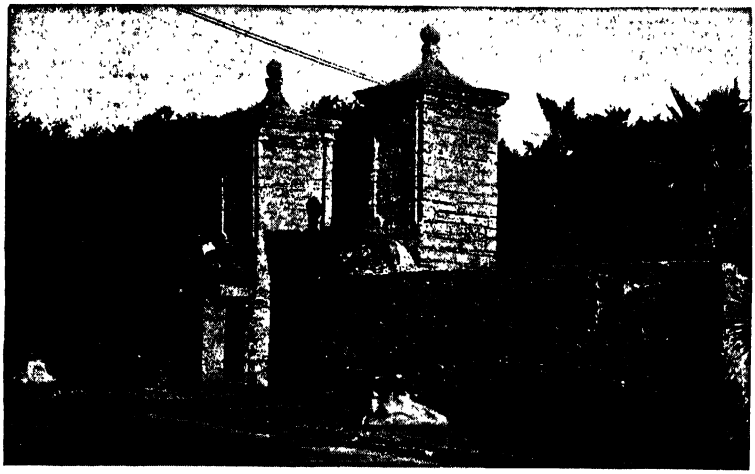
St. Augustine, Florida, the oldest settlement in the United States, was founded by the Spanish in 1565, and Florida was ceded to the United States in 1819, little more than a century and a quarter ago. Many evidences of Spanish occupation remain, though much of the Spanish town was destroyed by fire in 1914.

Roanoke Island, off the coast of North Carolina, was the site of the first English settlement in America, the Lost Colony of Roanoke. Here Virginia Dare was born (1587), the first white child of English parents to be born in the New World. Every year thousands of people visit Roanoke to see the historic pageant of the Lost Colony which is held there. Another shrine in this region is the Kill Devil Hill National Memorial, on the spot where the Wright brothers made their first successful airplane flight in 1903.

The remains of Jamestown, the first permanent English settlement (1607); Williamsburg, the colonial capital of Virginia; and Yorktown, where Cornwallis' forces surrendered to George Washington's army and the French fleet, are now included in the Colonial National Historical Park. Virginia has many other historic shrines, including Mount Vernon, the home of Washington; Monticello, Jefferson's home; the birthplace of Woodrow Wilson; and St. John's Church at Richmond, where Patrick Henry made his famous speech. Richmond was the capital of the Confederacy, and many bloody battles were fought upon Virginia soil during the Civil War. There, too, is Appomattox, where Lee's surrender ended the war between the states on April 9, 1865.

There are many historic shrines in New England, especially in Massachusetts. Plymouth, founded by the Pilgrims in 1620, is a prosperous modern town today. Nevertheless, it has many reminders of the Pilgrim Fathers and Mothers, and also of their little boys and girls. There is, of course, the famous Plymouth Rock, on which the Pilgrims are said to have landed.

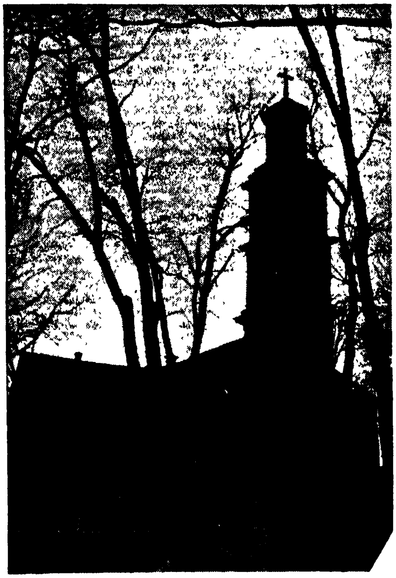
All of us have heard of the "midnight ride of Paul Revere." Look up the poem by Longfellow in the Poetry Index in Volume 20, and let us trace his route. There is the belfry of the Old North Church in Boston, where the lanterns hung; the common at Lexington, where the stone bears the noble words of Captain John Parker: "Stand your ground. Don't fire unless fired upon, but if they mean to have war, let it begin here." Then we go on the six miles to Concord and



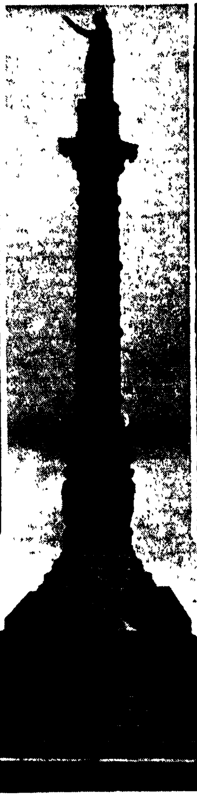
This ancient wall and gateway still stands in the center of St. Augustine, Florida. They were built in the days of the oldest settlement by white men in the United States. St. Augustine was founded by the Spanish in 1565 and plundered by Sir Francis Drake in 1586.

The Fort of San Marco, now called Fort Marion, at St. Augustine, is another relic of the Spanish days. We are told that the fort took 100 years to build. It was put up by Mexican convicts and Indian prisoners. They made it of coquina, which is a composition of seashells cemented with shell lime.

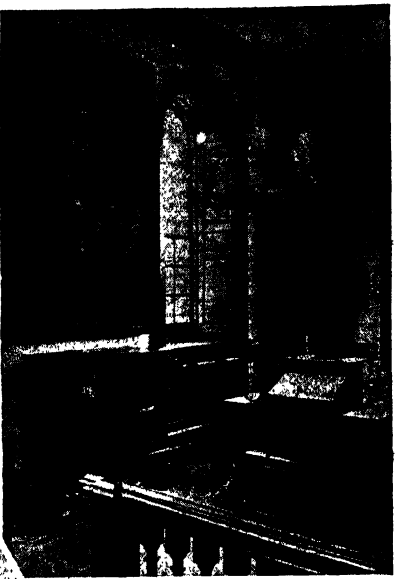
THE GLORIOUS PAST LIVES ON IN VIRGINIA



The Church of St. John, oldest in Richmond, Virginia, scene of Patrick Henry's fiery address: "Give me liberty or give me death!" in 1775.

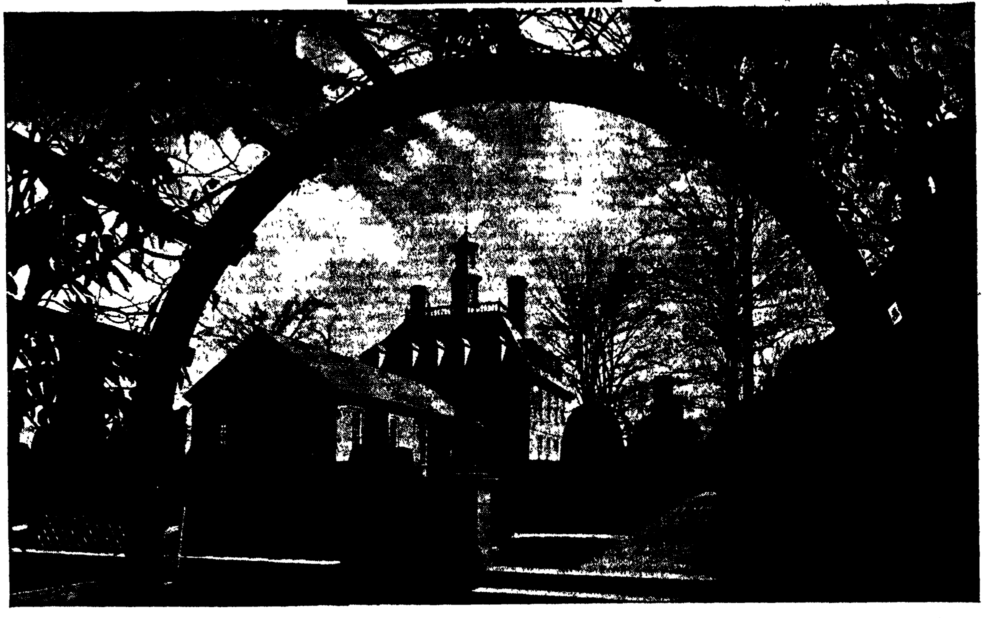


This monument in nearby Yorktown marks the spot where Cornwallis surrendered to Washington in 1781.



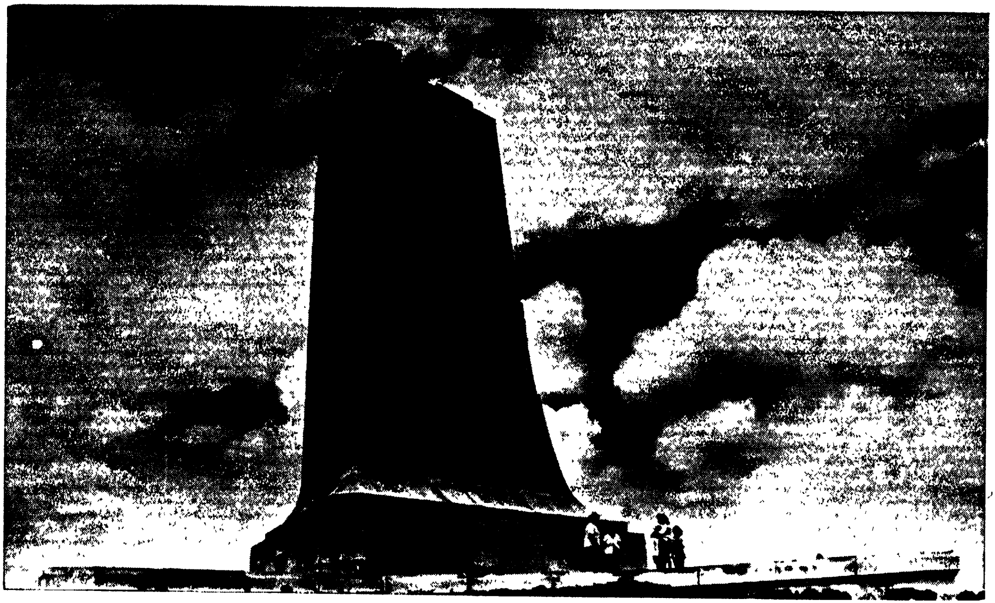
A room in the Colonial Capitol at Williamsburg, Virginia, that used to echo the voices of the Burgesses arguing over new rights and proposed laws.

Photos, upper left, Ewing Galloway; upper right and center, Philip Gendreau; below, courtesy, Williamsburg, Inc. Virginia State Ch. of Com.



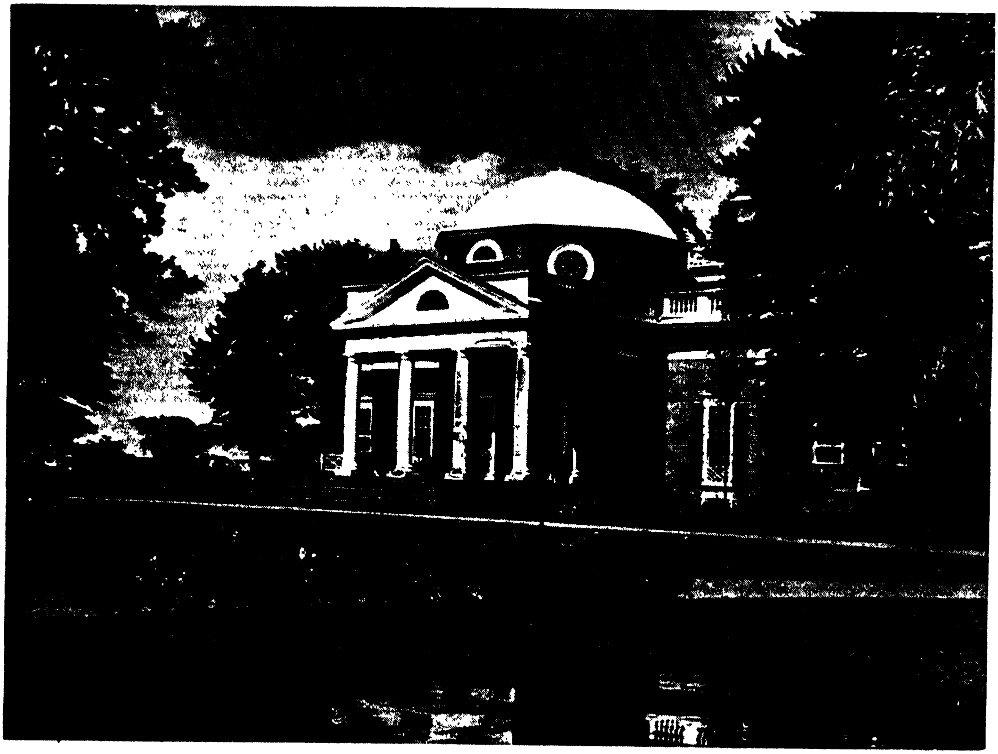
Today you may walk through the formal English garden behind the restored Governor's Palace in Williamsburg.

MODERN MONUMENT AND GRACIOUS HOME



North Carolina Dept. of Conservation and Development

The memorial to the Wright brothers' first motor-powered airplane flight, at Kitty Hawk, North Carolina.



Virginia State Chamber of Commerce

Jefferson planned in great detail his home at Monticello, near Charlottesville, Virginia, where he lived until his death in 1826. It stands on a hilltop, commanding a fine view, and is visited by thousands every year.

RELICS OF OUR PILGRIM FOREFATHERS

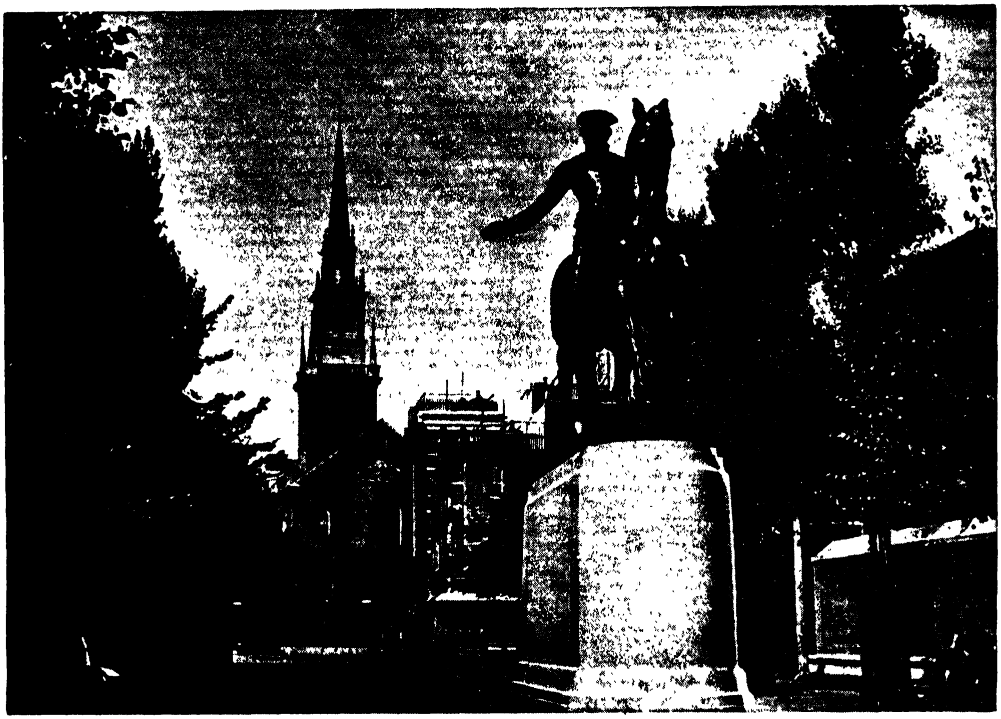
The Old Fort and first meeting-house of the Pilgrims stands on the top of Burial Hill, Plymouth, Massachusetts.

Pilgrim Hall houses relics and books.

Interesting old gravestones mark the last resting place of many of the first settlers in Plymouth, on Burial Hill.

Ewing Galloway

Here on Leyden Street, the first street surveyed in America, stands a replica of the thatched log hut or "Common House" erected in 1621.



Charles Phelps Cushing

Cyrus Dallin's statue of Paul Revere, near the Old North Church, Boston, where Paul saw the signal lanterns.

understand, as never before, Emerson's Concord Hymn:

> By the rude bridge that arched the flood,
> Their flag to April's breeze unfurled,
> Here once the embattled farmers stood
> And fired the shot heard round the world.

The story of the fight is told in our chapter on the Revolution. Returning to Boston we find many other places of historic interest besides the Old North Church and the home and grave of Paul Revere. You must certainly see Faneuil Hall, where so many meetings were held in the stirring days that led to the Revolution. Then there is the Bunker Hill Monument and the State House.

We have all been thrilled by the story of the taking of Fort Ticonderoga in New York State by Ethan Allen and his Green Mountain Boys. This was one of the most daring exploits of those exciting days. We must remember, too, that some of the military stores captured there were of great use to Washington in the siege of Boston.

Philadelphia is another town rich in historic shrines. Here the memory of William Penn is kept green; here the Continental Congresses met; here the Declaration of Independence was adopted; here is the Liberty Bell; here the Constitution was made. Important battles were fought near Philadelphia, and at Valley Forge you can almost imagine that you see the blood-stained footprints of Washington's ragged soldiers in the snow. Philadelphia was also the seat of the Federal government from 1790 to 1800; and Benjamin Franklin lived there during the greater part of his long and useful life.

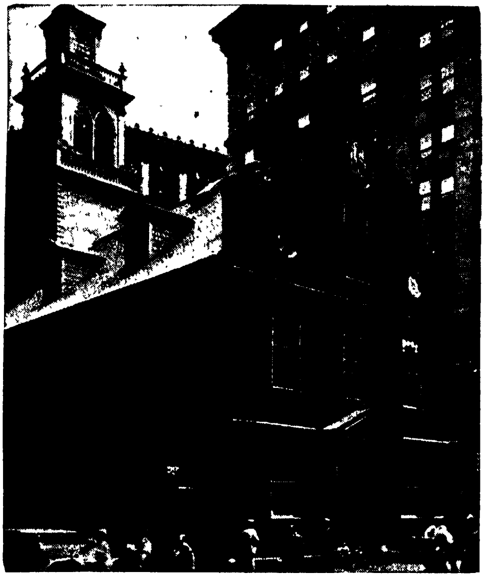
Abraham Lincoln could have happened nowhere except in the United States, and even now it seems impossible to explain this remarkable man. The Index in Volume 20 will give you the references to his life, and we have in our book shown you many pictures of scenes connected with his life; but his birthplace seems the most wonderful. Around the rude cabin in which he was born there is now a marble building to protect it.

Gettysburg was the high-water mark of the Confederacy in the Civil War. From the time of this battle the fortunes of the South began to decline. The whole battleground is now a national cemetery and memorial park. It was here that Lincoln gave his wonderful speech, which we call

HISTORIC SPOTS IN OLD BOSTON

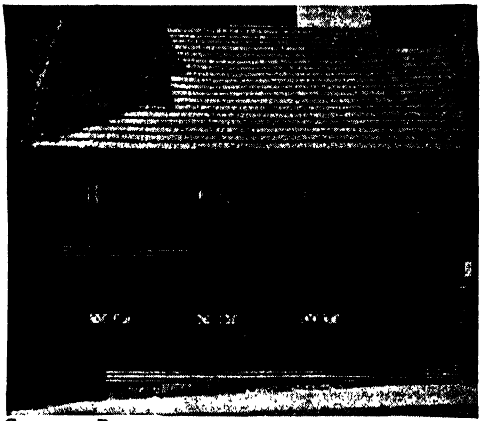
Philip Gendreau

Faneuil Hall, built in 1740 as Boston's town hall and public market, is known as "The Cradle of Liberty."



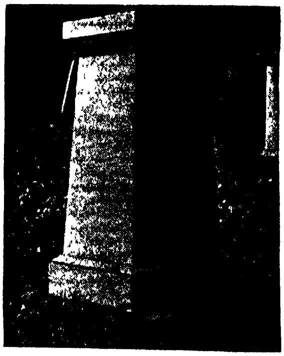
Philip Gendreau

The Old State House on Washington Street, Boston.



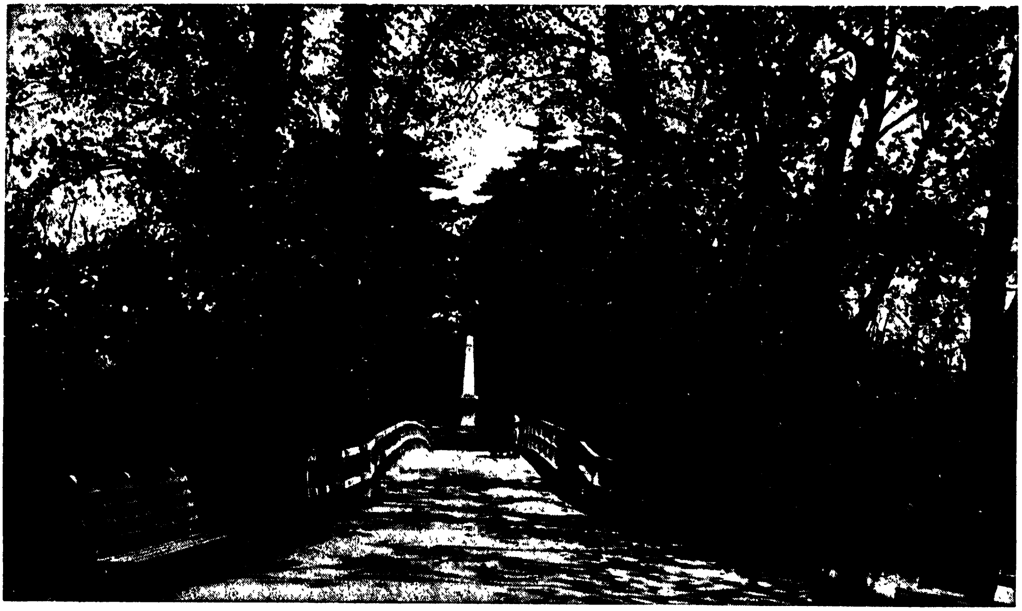
Courtesy, Boston Chamber of Commerce

Paul Revere's house, built soon after the Boston fire in 1676. Here Revere lived from 1770 to 1800.



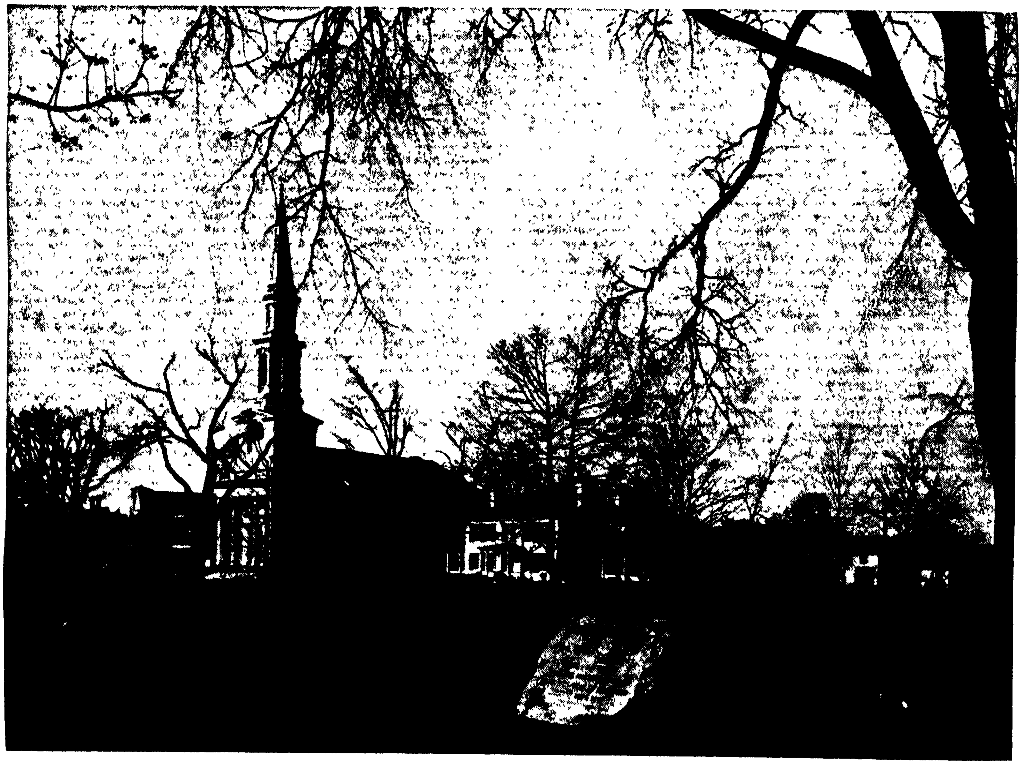
George Brayton

This stone marks the grave of Paul Revere in the Old Granary Burying Ground in Boston.



Both photos by Ewing Galloway

"Here once the embattled farmers stood, and fired the shot heard round the world," wrote Emerson in his hymn sung at the dedication of the Concord Monument shown here across "the rude bridge that arched the flood."



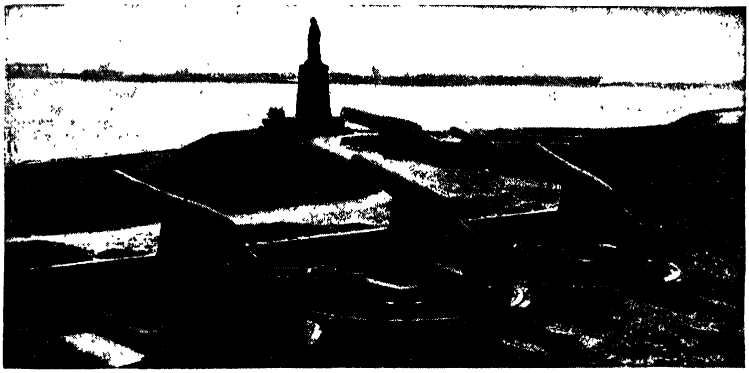
Where the Minutemen stood on Lexington Common when Captain John Parker spoke the historic words on the stone marker: "Stand your ground. Don't fire unless fired upon. But if they mean to have a war, let it begin here."

the Gettysburg Address, brief but immortal.

Far away on the Pacific Ocean we find shrines which are both historical and religious. In 1769, under Father Junipero Serra, a Franciscan mission to the Indians was established in honor of San Diego. By the year 1823 twenty other missions had been built along the King's Highway in California. Some have disappeared, but others are still in use. The good fathers converted the Indians and persuaded them to live settled lives. In and around the missions they taught the Indians agriculture and simple handicrafts.

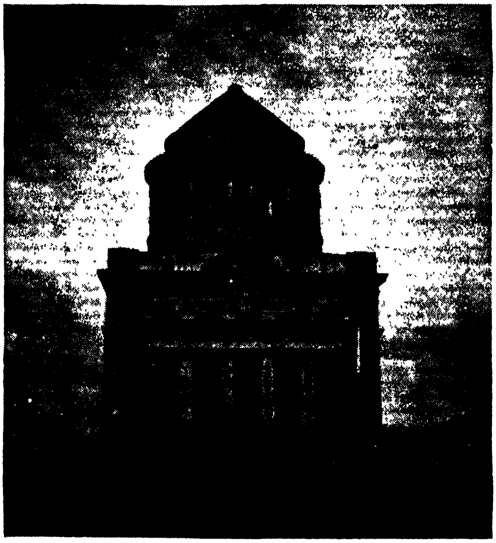
Another mission, which later played a tragic part in the history of Texas, was San Antonio de Valero, often called the Alamo (cottonwood) Mission because of the grove of trees in which it stood. It was founded in 1718 and the city of San Antonio has grown up around it. Within a century after it was founded the Indians disappeared from the region around the mission and it was abandoned. Then the chapel was sometimes used as a fort. In 1836, during the war of Texas Independence, about 180 Texans, including W. B. Travis, James Bowie and David Crockett, were besieged within the Alamo chapel by several thousand Mexicans. When the besiegers forced an entrance, after nearly two weeks, only five of the defenders were left alive. These five were killed by the victors. Afterward "Remember the Alamo" was the battle cry of the Texans. The Alamo is today one of the great historic shrines of Texas and of the United States because of the brave men who died there.

THE NEXT STORY OF THE UNITED STATES IS ON PAGE 6841.

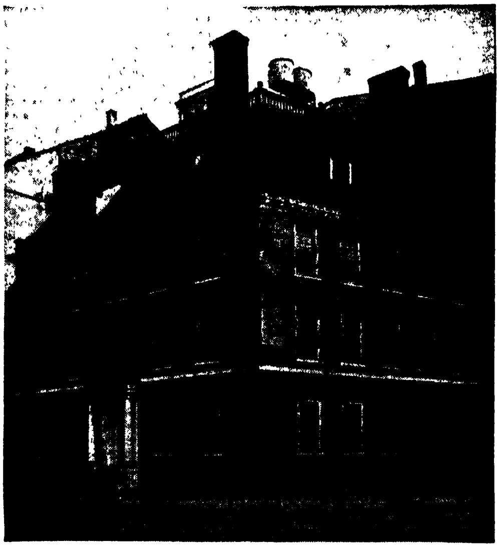


Fort McHenry, Maryland. It was the heroic defense of this fort during the bombardment by the British in 1814 that inspired THE STAR-SPANGLED BANNER.

Photo left, Courtesy U.S. Department of the Interior. Below, left, American Museum of Natural History; right, Cosmo



Grant's Tomb, on Riverside Drive, New York, where a general who later became president now lies in state.



Fraunces' Tavern, New York. Here Washington delivered his farewell address to his officers in 1783.

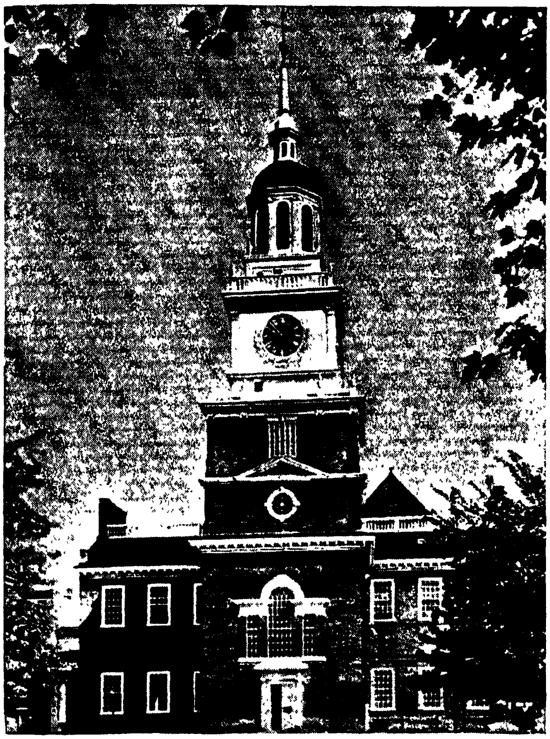
FORT TICONDEROGA, NOW A MUSEUM

The ruins of old Fort Ticonderoga, in upper New York state, originally built by the French, later occupied by the British. In 1775, Ethan Allen and his Green Mountain Boys captured the fort in a daring daybreak attack. Allen told the British commander to surrender, "In the name of the Great Jehovah and the Continental Congress!"

Philip Gendreau

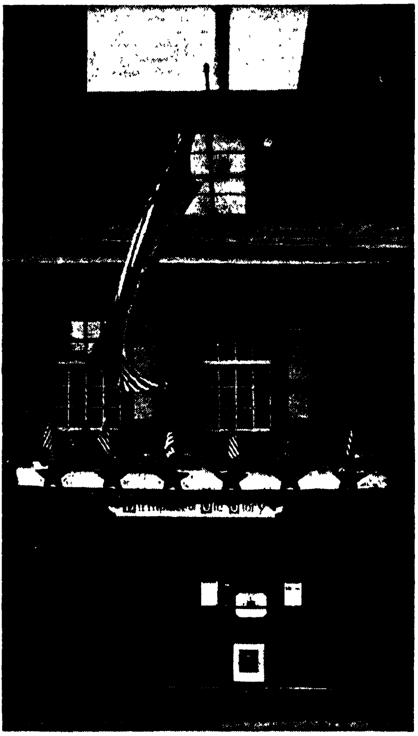
If you visit the site of the fort today, you will find it restored as it probably looked in Revolutionary times, and kept as a museum. The ancient guns are mounted on the wall overlooking Lake Champlain.

SOME FAMOUS PHILADELPHIA FIRSTS



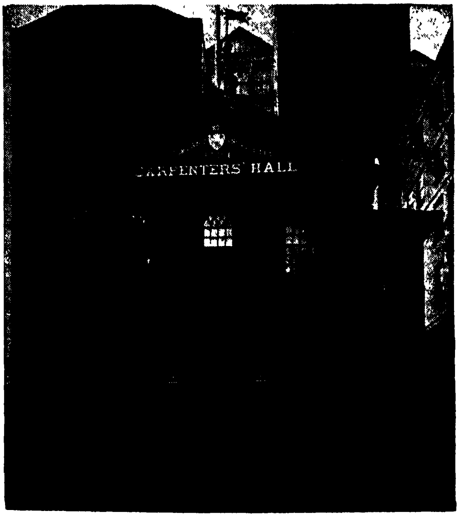
Pennsylvania Dept. of Commerce

Independence Hall, so named because it was here that the Declaration of Independence and later the Constitution were adopted by the Continental Congress. Inside, on the first floor hall, hangs the original Liberty Bell.



© Edward Walsh

This is believed to be the home of Betsy Ross, the Philadelphia seamstress who according to tradition made the first "Stars and Stripes". The house is near Independence Hall.

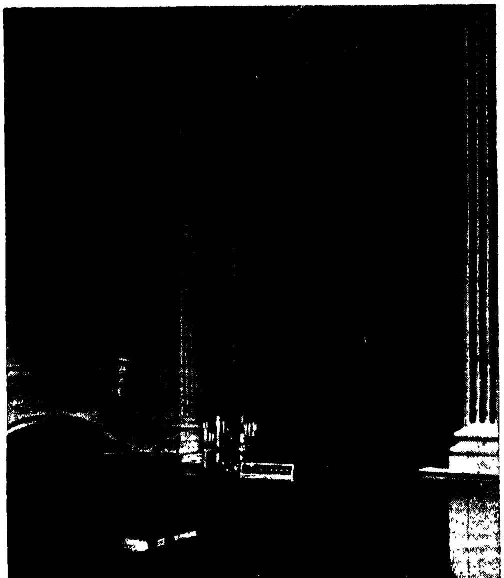


The meeting-place of the First Continental Congress in 1774 was Carpenters' Hall on Chestnut Street. It was built by the oldest trade union in the city.

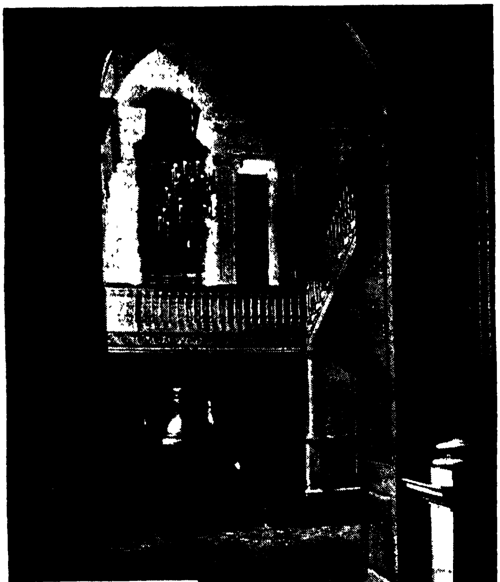
Both photos, Philip B. Wallace

William Penn, the Quaker founder of Pennsylvania, built this brick house in 1683. It is now preserved as the first state house, in west Fairmount Park.

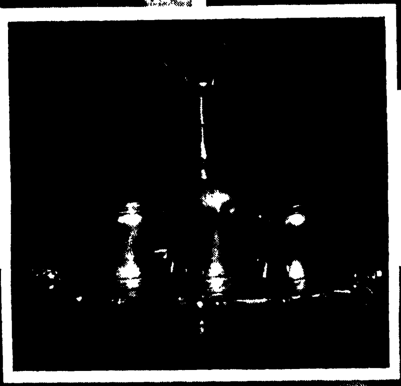
INSIDE INDEPENDENCE HALL



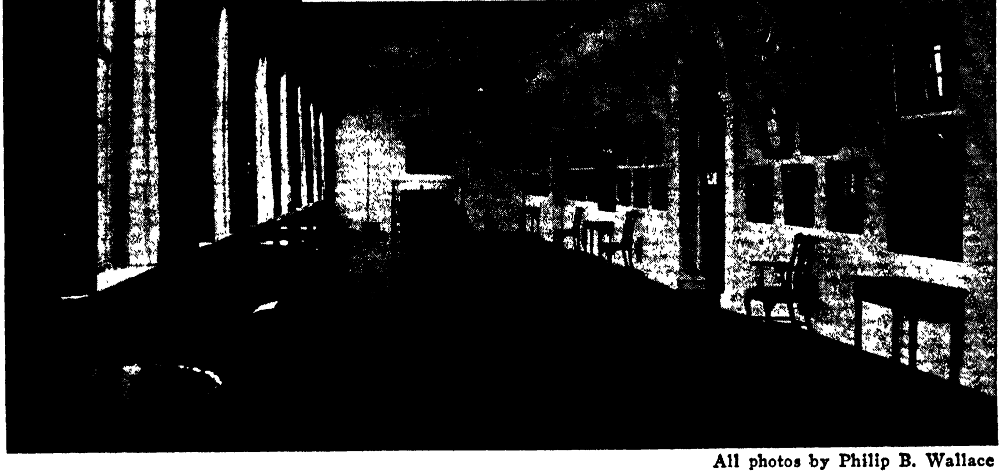
The President's chair, and the table on which the Declaration of Independence was signed. Note the draft bowl used in Washington in World War I.



The Liberty Bell which pealed from the tower of Independence Hall on the signing of the historic document.



This silver inkstand and sand-shaker (used as blotters) are on the table shown above, left.

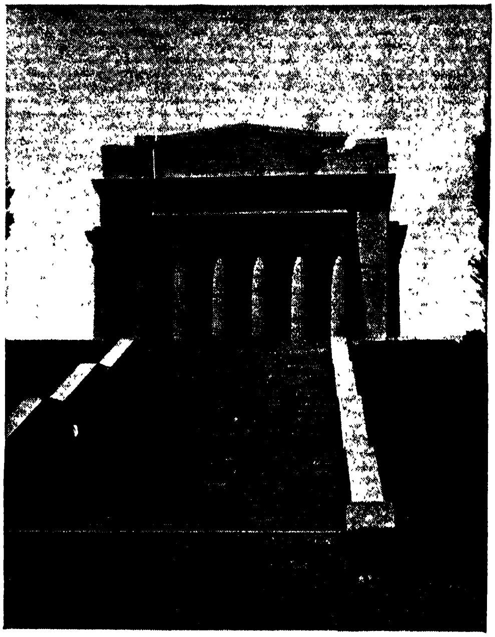


All photos by Philip B. Wallace

The Banquet Room with a portrait gallery of the signers of the Declaration of Independence for the thirteen states.

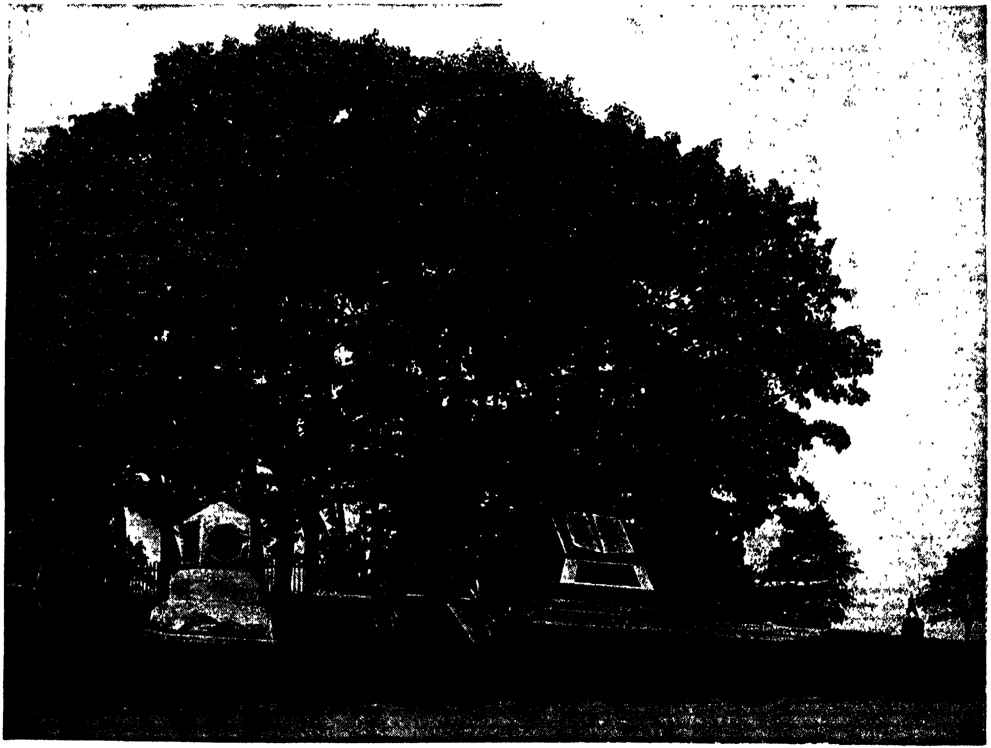
IN HONOR OF ABRAHAM LINCOLN

Abraham Lincoln was born in the log cabin shown here, on a farm near Hodgenville, Kentucky.



The log cabin is now inclosed in the impressive marble memorial hall pictured.

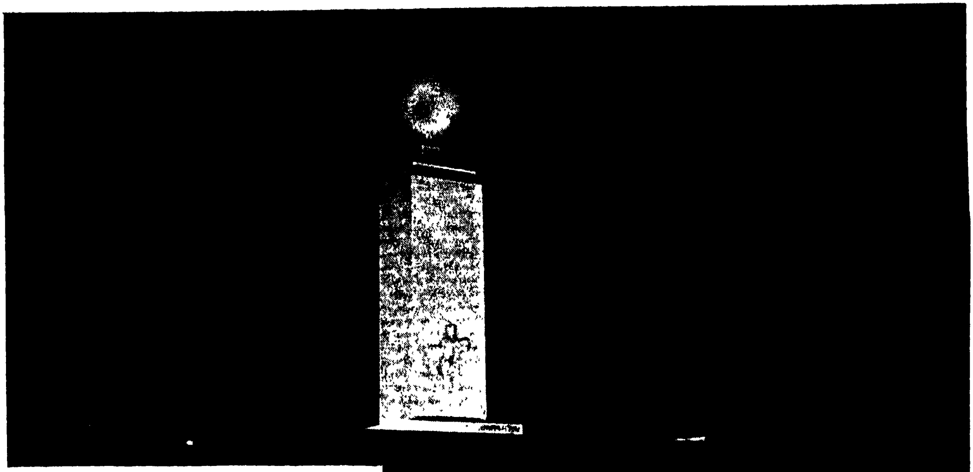
Both photos, courtesy Illinois Central Railroad Co.



Ewing Galloway

This grove marks the turning of the tide against the South and the northernmost point of the Confederate advance at Gettysburg. President Lincoln spoke here his immortal words dedicating the field as a national cemetery.

FOR THE FALLEN IN TWO WARS



Courtesy, Dept. of Interior

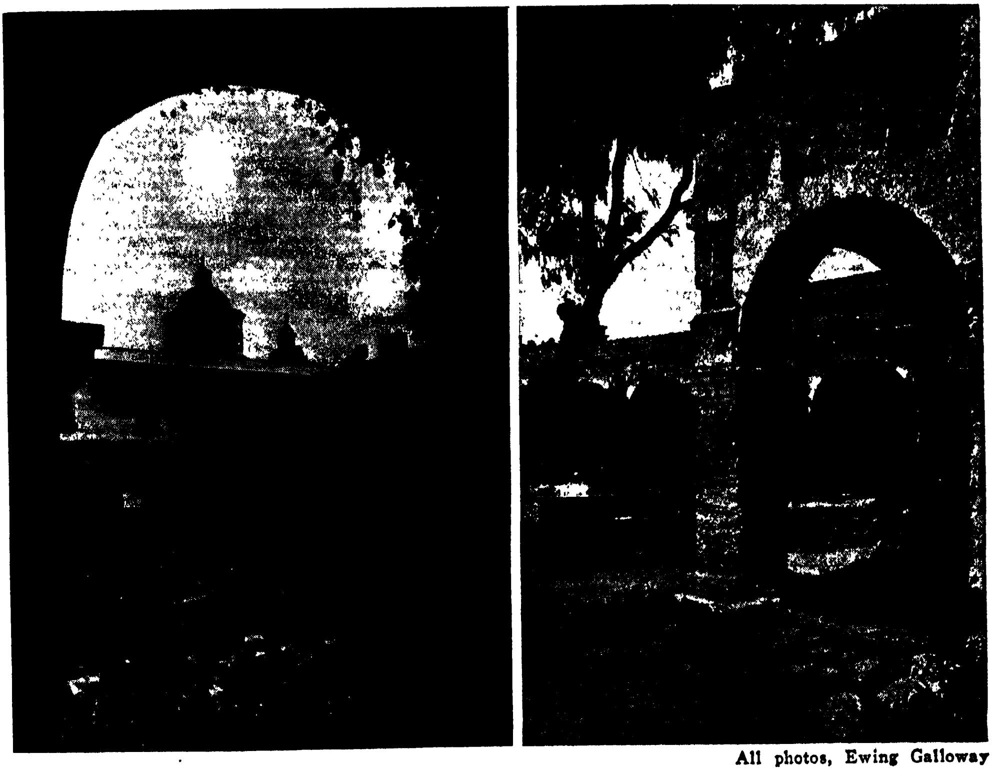
The flame of eternal peace glows above the Gettysburg Peace Memorial, dedicated by President Franklin Roosevelt in July, 1938.

The Memorial Arch at Valley Forge bears Washington's tribute to "the incomparable patience and fidelity of the soldiers."

The battlefield of Gettysburg, now a memorial to heroes of the Civil War. The statue, at left, is of Confederate General John Buford from Kentucky. The statue at the right is of Union General Joseph Jones Reynolds.

SHRINES IN THE WEST

The heroic defense of the Alamo, San Antonio, Texas, is one of the most thrilling episodes in American history. Here, in 1836, a force of 180 Texans was besieged by several thousand Mexicans, and held out for two weeks.



All photos, Ewing Galloway

Two old Spanish missions of California. On the left, San Juan Capistrano, and on the right, San Luis Rey.

FRENCH—*A Visit to Fairyland*

First line, French; second line, English word; third line, as we say it in English.

Un matin une petite fille s'assit dans un jardin jouant à ses poupées.
One morning a little girl herself sat in a garden playing at her dolls.
One morning a little girl sat in a garden playing with her dolls.

Tout à coup une fée apparut. "Veux-tu aller dans le pays des fées?"
All at blow a fairy appeared. "Wishest thou to go into the country of the fairies?"
Suddenly a fairy appeared. "Would you like to go to fairyland?"

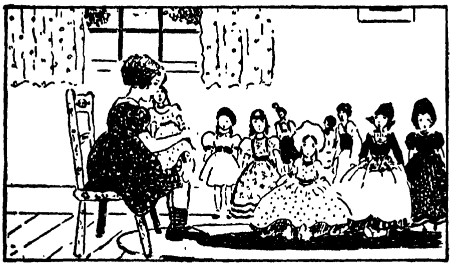
"Oui!" La fée agita sa baguette, et elles s'envolèrent.
"Yes!" The fairy agitated her wand, and they themselves flew away.
"Yes!" The fairy waved her wand, and they flew away.

"Voici le pays des poupées!" s'écria la petite fille. "Voilà ma poupée perdue!"
"Here is the country of the dolls!" herself cried the little girl. "There is my doll lost!"
"This is doll-land," cried the little girl. "There is my lost dolly!"

"Tu m'as abandonnée à la pluie, mais les fées m'ont soignée," dit la poupée.
"Thou me hast abandoned to the rain, but the fairies me have cared for," said the doll.
"You left me out in the rain, but the fairies took care of me," said the doll.

"Pauvre Bella! Es-tu heureuse dans le pays des fées?" "Mais, oui."
"Poor Bella! Art thou happy in the country of the fairies?" "But, yes."
"Poor Bella! Are you happy in fairyland?" "Why, yes."

"Que fais-tu toute la journée?" "Nous jouons, nous chantons, et nous dansons."
"What dost thou all the day?" "We play, we sing, and we dance."
"What do you do all day?" "We play, we sing, and we dance."



"Qui sont toutes ces autres poupées?" "Des poupées qui ont perdu leurs mères."
"Who are all these other dolls?" "Some dolls who have lost their mothers."
"Who are all these other dolls?" "Dolls that have lost their mothers."

"Puis-je rester ici pour jouer avec toi?" "Demande cela aux fées."
"May I remain here for to play with thee?" "Demand that to the fairies."
"May I stay here to play with you?" "Ask the fairies."

A ce moment une cloche sonna, et la petite fille se réveilla. C'était un rêve!
At that moment a bell sounded, and the little girl herself awoke. This was a dream!
Just then a bell rang and the little girl awoke. It was a dream!

THE NEXT FRENCH STORY IS ON PAGE 6954.

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